MONOGRAPH

OF THE

BRITISH CICADÆ

OR

TETTIGIDÆ.

BY

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AUTHOR OF A 'MONOGRAPH ON BRITISH APHIDES.'

. . . . . "and flashed as those
Dull coated things that making slide apart
Their dusk wing-cases, all beneath them burns
A jewell'd harness ere they pass and fly."

"The small becomes the dreadful and immense."

"'Ακρίδι τᾷ κατ' ἄρουραν ἀηδόνι καὶ δρυοκοίτα
τεττιγι ξυνὸν τύμβον ἔτευξε Μυρώ,
παρθένιον στάξασα κόρα δάκρυ; δισσα γὰρ αὐτᾶς
παίγνι' ὁ δυσπειθὴς ὤχετ' ἔχων 'Αΐδας."

Epigram of ANYTÈ.

VOLUME I.

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PREFACE.

The section of the British Hemiptera-Homoptera treated of in this Monograph is a large one, and of some importance, though hitherto it has had few close investigators. Numerous memoirs and synopsides are scattered through magazines and scientific publications, but no well-sustained effort has been made to illustrate the group. The variations of form, and the complex structure of insects, call for every help; and it is with a view to such that the present Monograph, with litho-chrome plates, has been attempted.

Mr. S. H. Scudder, of Harvard College, Mass., has done, and is still doing, good work towards establishing the connection between ancient forms of the Rhynchota and those forms now living. Mr. W. L. Distant has also commenced a 'Monograph of the Oriental Cicadidæ,' for the Indian Museum. Such researches are of the highest interest; but, before comparisons can be adequately made, it is incumbent on biologists of the present generation to tabulate and describe the living species, which at any time may disappear, or, on the other hand, become modified through the action of forces upon life, the obscure motions of which are now being discussed by minds of the highest type.

Addison, in No. 121 of the 'Spectator,' writes:—"I could wish that out of several writers some one would

take each his particular species, and give us a distinct account of the frame and the texture of its parts, and particularly those which distinguish it from other animals. This would be one of the best services that they could do to mankind," &c. Bacon thought that it was within the capacity of man to control, and even to command, the forces of nature. But our steps in the investigation of biological problems must for a long time be faltering. Even the first great generalizations of Newton and of Darwin will require modification, as our knowledge becomes more exact, and our materials for reasoning, based on experiment, accumulate. In such a manner, safe induction passes into practical deduction, and experiment becomes the best proof of acquired knowledge.

The present treatise is offered to a discerning and not unkind public, with the hope that it may lessen the labour of the student by gathering together the researches of others into small compass. Here and there some new items have been added by the author towards the history of this interesting group of insects.

The comparison of specimen with specimen forms the basis of all zoological and biological research. Doubtless, after a comparison with identified living forms, collation with museum specimens is of the greatest value to the investigator. Specimens are not, however, open to the use of all. To those who have no access to them, figured monographs are of prime importance; but in consulting them, it must be remembered that the colouring of living specimens is often more marked than those of museum examples, which commonly lose their brilliance and freshness, however carefully preserved.

As to museum specimens, the late Mr. John Scott's cabinet has been unfortunately scattered. Fieber's collection of European Cicadinæ, it is believed, does not now exist in its entirety. But through the kindness of Mr. James Edwards, it has been in my power to acquire and represent numerous duplicates of his almost unique cabinet. I am also largely indebted to the liberality of Mr. J. W. Douglas, who is ever ready to help any earnest enquirer in entomological science.

Amongst others who have given material help, I would mention Mr. Philip Mason, of Newcastle-on-Tyne (the possessor of many of Scott's types); Dr. E. Capron, of Guildford; and Mr. G. C. Bignell, of Stonehouse, Devon. There are other friends, also, to whom, if I have not mentioned them in my text, I now tender my sincere thanks. I may be permitted here to note, that, through the enthusiasm of my daughters, I have been able to figure many brilliant forms, which otherwise I should have had to describe from cabinet specimens.

To Prof. Rupert Jones, I feel under obligation for kindly over-looking many of my proof-sheets.

The task of clothing scientific facts in such a garb as will be pleasing to the general reader is a hard one. Collateral subjects have been admitted into the Introduction of this work, which some few may think misplaced. Yet, in extenuation, it may be pleaded that "bones," even though they be scientific, are rarely interesting, except to the specialist. The general reader may ask that the facts brought before him shall not be presented in a too concentrated or a jejune form.

The author may have fallen on the rocks of Scylla in an attempt to change the character of a monograph, which must necessarily take something of an abstruse shape. He is sensible of many short-comings. A performance is mostly very different from an ideal.

None more feelingly than the investigator of natural law will echo the poet's words :—

> . . . . . "In seeking to undo
> One riddle and to find the true,
> I knit a hundred others new."

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Zett. ..... Zetterstedt. Insecta Lapponica.

January, 1890.] [In Eight Parts.—Part I.

MONOGRAPH

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ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

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INTRODUCTION.

The sequence which exists between law and natural phenomena must ever force itself interestingly on the attention of the earnest thinker. Pleasure must be felt in intelligently tracing the unmistakable signs of consistency and unity throughout the vast system in which man himself finds he is a mover. This oneness is well expressed in the Greek word Kosmos, and its correlative word Universe.

The insect-world, containing more than one hundred thousand species, is in itself a microcosm; but the multiplicity of its parts bewilders the student. It is only by a subdivision of labour and concentration of attention on the life-history of groups, that we can hope successfully to trace the complex rising out of the simple; or to note degradations of form effected through the disuse of parts or other like causes. Abnormal developments or growths that may come through the slow but persistent action of the environment or other influences on an animal's economy, may well be studied in single biological groups, and thus additional material may be gathered to permit of future generalisations.

Probably the ordinary scope of a Monograph is the description of the forms, life-history, distribution, &c., of the species contained in it. This will be a chief aim of this treatise, but at the same time, whilst the scientific

world is occupied with theoretical and hypothetical discussions on the subject of specific descent, remarks from time to time may be permitted, and thought not altogether irrelevant.

Although amongst insects the higher Hymenoptera perhaps elicit the greatest general interest, on account of their extraordinary social economy and their quasi-intelligence, the Hemiptera or Rhynchota show remarkable characters, and present many points for profitable study.

The present volumes are devoted to the study of the group known as the Cicadæ, which forms the second division (Homoptera) of the Rhynchotous or amandibulate insects, characterized by a sucking rostrum instead of cutting jaws for the supply of food to the æsophagus. Although some Cicadæ of the Tropics attain a great size; even to the expanse of seven inches across the wings, the group, so far as mere size goes, is but poorly represented in Great Britain, the largest example of which barely reaches more than an inch and a half.

We have, however, numerous smaller species, beautiful in colour, elegant in form, and singular in outline. Some have an interest from a grotesqueness of appearance and gait, which has earned for them the popular names of Frog-hoppers and Cuckoo-spits. These insects are often common on our trees, low shrubs, long grasses, and sedges. Although they belong to the section of insects commonly called Bugs, many of which are possessed of disgusting odours, the Cicadæ of Britain in this do not offend; neither do they often do injury to our crops; and thus they almost rise to the character given to them by many Greek poets, who called them "the most innocent and merry of animals."

I purpose to treat my subject under the following heads:—

Etymology and the ancient notices of the Cicada or Tettix.

Classical allusions and poetic myths relating to them.

A biological sketch of the writings and investigations of authors who have considered the subject.

A terminology and description of parts available for classification.

General remarks as to their life-history, reproduction, &c.

Diagnosis of species, accompanied by coloured representations of the British species of the insect.

Notes on variation and distribution.

Remarks as to the probable antiquity of the group, as shown by their remains in the rocks, amber, and fossil resins.

An appendix, with a bibliographical list of the chief modern authors who have studied the Cicadæ; and, finally, a short list of ancient and modern quotations, for reference and use of the curious.

Etymology of the words Tettix and Cicada.

As a preliminary to the more special portion of my subject, a few words may be permitted as to the etymology of the above words.

The "dry Cicada" was well known to Homer and Hesiod, and the word Tettix seems to have raised in the ancient poetic mind a kind of storm, difficult for us now to appreciate.

The first English author who wrote on the Cicada was Dr. Thomas Moufat or Mouffett, an English physician, who flourished in the reign of James I. In 1634 he wrote, in folio, a curious Latin treatise on Zoology, having for its title, 'Insectorum sive minimorum animalium Theatrum.' In this book he shows his erudition by copious extracts from both Greek and Latin authors. He devotes as much as ten pages of his work to the description of the Cicada. He attempts even something of an explanation of the origin of the words Tettix and Cicada; but when we take into consideration the remarks of our learned philologist, Dr. J. A. Murray, we need feel no disappointment that

Moufat failed in tracing the roots of these classic words. Dr. Murray writes to me:—"So far as I know, the Latin term Cicada is at present an ultimate fact to etymologists, which they cannot get beyond, nor as yet has there been any satisfactory root suggested. One does not even know to what ancient Italian dialect the word Cicada originally belonged. Unless a word may be traced to one of the general Aryan family, we have usually to be contented if we find it connected with a Latin word of established use, but with little or no expectation of learning where they got it. Of the origin of a vast body of Latin words, like Apis, we can now never know anything, since the old Italian dialects, out of which Latin rose, are virtually lost."

Again he remarks, that the original affinities of Latin and Greek are very remote, the most common objects having the most different names in the two languages. "On the other hand, here and there, affinities between Latin and Celtic are being discovered, and herein lies a hope that some light will eventually come on this subject." "Old Latin was essentially a Celtic language, as has been recently shown by Stokes. The points of contact with Greek are superficial and later, and these connections are chiefly literary or else superstitional." This opinion is, I believe, endorsed by my friend the late Rev. B. P. Pratten, from whose skill in philological questions I have often benefited, and to whose knowledge I am much indebted for unearthing little-known texts from classic authors. He thinks that the words "τεττα and κικα are, at any rate, *cognate*, and that they possibly have reference to the note made by the insect." The passage from one word to the other will not be thought difficult, when we remember how readily children, and indeed adults, interchange "t" with "k" sounds.

Hesychius gives us the phrase, κικκος και κιλλος, referring to the tenderness and dryness of summer; and Moufat hints some connection between κικκος = siccus (dry) and

Cicada. On the other hand, Dr. Murray points out that "clearly the stem is not κικκ = cicc, but that there *is* a certain parallel suggestiveness between κικαδα and τεττῖγα (accusative), though neither consonants nor vowels actually correspond."

It may be a question whether a chattering voice may have suggested the name Tettix for the so-called tree-cricket; or whether, on the other hand, the insect's name furnished the word τέττα, which represented "father" in the tone of voice in which the younger Greeks persuaded, or perhaps cajoled, their seniors. Τεττα might have been used somewhat in the sense of "daddy," in daddy-longlegs. But τεττα seems to have been used in various ways:—

> "Vox qua benevolentiæ aut honoris causa
> Junior Seniorem compellat."*

It is interesting to note how the childish words, "dada," "tata," and "papa" run through the tongues of many nations. Dr. Skeat curiously shows that we have it amplified in the compound word, "tittle-tattle."†

It cannot be doubted that the ancient Etrurians were acquainted with Greek art; and, if so, it is hard to think that they never affected any modification of Greek words. But whether Cicada has or has not a connection with Greek, I leave to experts.

Dr. Moufat gives us the obsolete word, ζειγαρ, for a Cicada, but however that may be, the last word recalls the modern Cigarra in Spanish, Cicala and Lazenzala in Italian, Cigalle in French, and, according to Moufat, Guituole in Arabic.

Although there appears to be no example of the interchange in Latin of the letters "c" and "s," such examples do occur in the Romance languages, such as "placere" into "plasir," and the like. There can be no connection between the Latin words "sica" (a dagger) and "cicada," as some have hinted; but when we note the remarkable sword-like ovipositor, sheathed

* *Vide* 'Lexicon Hederico.'
† *Vide* Skeat's 'Etymological Dictionary.'

under the abdomen of the female, there is at any rate a singular coincidence of sound in the Latin name of the creature.

Though not much to the point, it may be noted, that in late Ptolomaic times the Greek sigma was often written C. In the Fayum tombs, ICIΩN=Ision, MAPEIC=Mareis, ΔHMHTPIOC=Demetrios.

The Cicada was, according to Moufat, known to the Greeks under several different names. Thus we have *βαβαξ* (a babbler or chatterer), *κερκώπη* (a crafty one), *καλαμιδαι* (reed players), *τέττιγονια, τέττιγομητρα.* The last name was given to the smaller kinds, which were once believed to be the mothers of the larger sorts.

Perhaps the first notice of the Tettix occurs in the 'Iliad,' where Homer says, "Good orators are like the Tettiges, which, sitting on the trees of the woods, send forth a delicate music"; or as Lord Derby more elegantly translates the words:—

> "Sage chiefs exempt from war, but in discourse abundant,
> As the cricket on high,
> From the topmost branch of forest tree sends forth
> His delicate music." . . . .*

Again, Diomed says to Sthenelos to calm his anger, "*Τέττα σιωπῇ ἧσο,*" "Father, be silent."† The word *τέττιξ*, also, was used for a chatterer or senseless fool; as when Ulysses, in utter scorn, calls Thersites a cricket-speaking fool or babbler.‡ In later times, also, *τέττιξ* was synonymous with a parasite or flatterer.

Hesiod, living perhaps not much later than Homer, says, in his 'Works and Days,' "When the Skolymus flowers, and the tuneful Tettix sitting on a tree in the weary summer season pours forth, from under his wings, his shrill song," &c.§ And, in the 'Shield of Hercules,' also, he makes an allusion, in very similar words, to "the dark-winged Tettix, when he begins to sing to men of the coming summer; he whose meat and drink is of the refreshing dew, and who all day

* 'Iliad,' Transl. III. p. 181. † 'Iliad,' IV. p. 412.
‡ 'Iliad,' II. p. 246. § Hesiod, 'Works and Days,' p. 580.

long, and at break of day, pours forth his voice."* These lines, Mr. Martyn says, have been imitated by Virgil in the hexameter:—

"Et cantu querulæ rumpent arbusta Cicadæ."†

With reference to the supposed fasting habits of the Cicada, a Greek writer exclaims (speaking to his patron as if he were a parasite), "οὐ ἔιμι τέττιξ οὐδὲ κοχλία," as if urging, "I feed neither on dew, nor on grass," which, Dr. Moufat points out, has some affinity with the sentence in Theocritus, "Μη πρὼκας σιτίξετι ὥσπερ τέττιξ."

On the ancient Myths and Classical allusions to the Cicada.

Some wonder may be expressed as to why this insect should have called forth so much interest in olden time. How far the ancient Egyptians used the Cicada to typify their religious theories, it is now difficult to say. Moufat says (he does not tell us where) that this insect was pictorially represented in their tombs, but he remarks, "Novi Hieroglyphici eas non-nunquam musicos, non-nunquam garrulos significare frivoli contendunt," which rather crabbed sentence may be rendered:—"Recent hieroglyphists frivolously say they (the Cicadæ) symbolize sometimes musical, sometimes garrulous persons."

In India there would seem to have been some early peculiar Buddhistic idea, connected with purification, involved in the life of a Cicada. Thus, in the Institutes of Menu (the Indian king, who flourished circ. 350 B.C.), in a passage where punishments for certain crimes are awarded by migrations into the bodies of beasts, the stealer of salt is condemned to expiate his crime in the body of a thirsty Cicada.

The late erudite Dean of Chichester, Dr. Burgon, suggested in conversation that the quasi-sacred character of this insect may be partly due to an observation of

* Hesiod, 'Shield of Hercules,' p. 393. † 'Georg. III.,' l. 328.

the sudden burst of the winged form, as it rises from the ground, under which it had undergone its transformation, to give forth its endless song in the sunshine of day,—a modification perhaps of the old Psychic myth, prevalent all over the world.

When we remember that Greek ideas leavened the Indian mind long after the invasion of Alexander (which amongst other things we may note in the modified architecture of certain Indian temples), it does not seem to be improbable that conversely Eastern mythic fancies may have passed westwards through Persia into Greece.

From Plato we learn that the Tettix was sacred to Apollo, "because it everlastingly sung to the sun." Greek coins may be seen in various collections with a figure of the Sun-god, accompanied by the sacred Tettix. Gems and coins in like illustration will be found engraved on Plate I. of Vol. II. of this work. From some such cause, in praise of Apollo the inhabitants of Tæneros(?) are said to have raised a monument to the Cicada, and to have engraved thereon an epicedeum or elegy to the insect.

Plato remarks in his 'Phædrus' that, "according to rumour, the Cicadæ were men before the Muses were born,(?) but that they were so overcome by the pleasures of song that they neglected to eat and drink; and so unawares they died. From these men the race of Cicadæ sprung, having received this boon from the Muses, that until they died they should need no nourishment whilst singing, and that then they should return to the Muses and inform them who of the mortals worshipped them most." Cicadas made themselves particularly dear to Terpischore, by telling her who in the dance most honoured her.

As to the insect's voice, Plato commends the broad eloquence of Timon Sillographus, and compares it to the strain of the Tettix. He also says, "As music soothes the mind and dissipates fatigue, so the plowman loves and cherishes the Cicada for its song."

Aristotle, the father of Natural History, says of the Tettix that there are several kinds, which differ in size; and that this insect, unlike all other animals, has no mouth. He seems to have mistaken the ovipositor of the female for a sting, or else a tongue, by which it feeds on dew, supposed to be its only sustenance. He further says that the chirpers (ἠχεται) are divided under the thorax, and have a visible membrane under the midriff, which the smaller sorts (τέττιγονια)* have not. In another place he remarks, that insects neither articulate sounds nor connected speech, but that they make a noise by the "friction of their breath," &c. Afterwards he says the Tettiges seem to sing most continuously after the Solstices.†

In Strabo's 'Geography,' we read of a musical contest for a prize between Eunonius and Aristomus, during which, after a passionate appeal to Apollo to supply the deficiency of a broken string, a Tettix lights on the lyre of one of the players. Of course the victory is accorded to him who has his music supplemented by the Cicada's help. Solinus brings this curious contest to memory, and the incident has been alluded to by modern poets.

Difference of opinion has always existed as to whether the Cicadæ have any pretence to either song or music. It is true that they were called (φιλυμνοι) psalm-singers by the Greeks, and also likened to players on the shepherd's-reed; yet the accounts given to me by friends, who are well acquainted with their monotonous stridulations, agree better with Virgil's notion, that their music is both wearisome and changeless. A friend, the observant colonel of an Indian regiment, likens it to a prolonged iteration of the letters "kr-r-r-r, kr-r-r-r," which subsides at intervals into a few single notes represented by "krick-krick-krick." Then there comes a short cessation, and the strains are commenced again with a terrible pertinacity.

* 'Departibus Anim.,' iv. 7, 7. † Ibid., x. 9, 2.

It is pretty clear that Hercules had no feeling for such music, if we may credit Solinus, the naturalist and geographer, who flourished circ. 100 A.D. He was considered such a plagiarist of Pliny, that he was called "Pliny's ape." Solinus says, "This is the fable which gave rise to the custom of the Locrians, who impressed the image of a Tettix on their coins." The bank of the river on which Locris was built was covered by legions of screeching Cicadas, whereas they were never heard (so runs the legend) on the opposite bank, where stood the town Rhegium. In explanation of this circumstance, the Locrians pretended that Hercules, wishing one day to sleep on this bank, was so tormented by the "sweet eloquence" of the Cicadas, that, furious at their concert, he asked of the gods that they should never there sing evermore; and his prayer was granted!

The discord produced by thousands of individuals echoing to each other in the higher jungles of India is also testified to me by General Strachey, who knew them well as inhabiting the trees on the slopes of the Himalaya.* It is clear, therefore, that the interest taken in the Cicadæ did not wholly proceed from the charm of their song.

According to Strabo and Pausanias, the Tettix seated on a harp was a recognized symbol of the Muses.

Mr. Cecil Smith, of the British Museum, has kindly given me the following notice relating to the Tettix in Greek art. "The Tettix (Cicada) has frequently been confounded with the English grasshopper, and from this mistaken idea, representations of the Greek locust in Greek art have been repeatedly considered as representations of the Tettix."

This last insect may be seen sculptured on one of the marble reliefs in our National Collection; but

* Sir Joseph Hooker, also, whilst remarking on the wonderful abundance and often the beauty of insect-life in the Rungeet Valley, not far from Darjiling, says, "The great Cicadas were everywhere lighting on the ground, where they uttered a short *creaking* sound, and anon disappeared as if by magic."—*Vide* 'Himalayan Journals,' vol. i., p. 143. 1855.

perhaps the best extant representations are those stamped on some Athenian coins, lithographic drawings of three of which I give on the first Plate of this volume. It is very possible that many of the early representations in gold-work which have been called "bees," in reality are Tettiges, which on coins often have the appearance of bees.*

The ancient classic story of Aurora and Tithonus, alluded to by Virgil, is familiar to most. Tithonus, the beautiful son of Laomedon, a king of Troy, was beloved and carried off by Aurora. He asked of her to be made immortal, and the boon was granted; but he, forgetting to include perpetual youth and vigour in his request, became old and infirm, and his life insupportable. Therefore he prayed Aurora that he might die; but, as he was immortal, the goddess changed him into a complaining Cicada.†

Æsop, who probably was a contemporary of Anacreon, refers in one of his fables to the Cicadas, who, in the winter, unavailingly asked food of the ants. This story, doubtless, is the foundation of the similar French tale told by La Fontaine.

The Athenians were proud of being of the ancient stock, born from the soil, and styled themselves αὐτόχθονες, like the Cicadæ. Accordingly, as a mark of their antiquity, they twined golden Tettiges in their flowing hair, which ornaments they would in no ways permit a stranger to use. Such fops were called Tettigophori. The ornament is believed by some to have been a pin with a golden Tettix for its head, and employed to gather the hair into a knot.

* Through the kindness of my friend Mr. L. E. Upcott, of Marlborough College, I shall be able to show in one of my later plates that the Tettix was occasionally taken as a subject for engraving on gems; and on the same plate, through the liberal loan of Mr. John Evans, F.R.S., I represent an ancient Roman ornament, probably as old as 300 B.C., cut cleverly from a block of chalcedony. The stone is drilled from end to end in such a manner as, through a string, it may be used as an amulet round the neck.

† In late Greek times the word Tettix passed almost as a synonym of a querulous old man.

It is not very obvious why the Cicada specially was praised as "earth-born." Moufat says as to this point:*—"Mira est Cicadarum generatio, ut apud auctores legimus. Nam lutum si non debito tempore effodiatur, Cicadas progignere testatur Paracelsus, atque ante eum Hesychius. Ob hanc causam Plato, Cicadas homines olim fuisse affirmat ex terra ortos, Musarum vero beneficio in Cicadas versos." From which we may gather that moist earth breeds Cicadæ spontaneously, and, accordingly, Paracelsus recommends that the ground should be early ploughed, otherwise the Cicadæ become an injury and pest to the farmer. The assumption of the title "earth-born," by the ancient Greeks, probably had reference to the line in Homer, where he says of the Greeks:—

> "Noble-souled Erechtheus's heritage,
> Child of the fertile soil by Pallas reared."†

As Erechtheus was one of the first traditional chiefs of Athens, the inhabitants, as children also of the soil, revered him.

The Greeks included Cicadas amongst their pets, and confined them in rush-made cages for their song, and, it would appear also, to watch their amatory ways. We quote from Moufat's text, which is by no means so clear as might be wished:—"Sane Lyæ (Lysias?) verba illa ex Alexide in Thrasone Atheniæ citata σοῦ δε ἐγὼ οὐ πώ ποτε εἶδον οὐδὲ κερκώπην, γύναι, οὐ κίτταν, οὐδ' ἀηδόν', οὐδε τέττιγα, οὐδὲ τρυγόνα fidem faciunt amplissimam vocalem fuisse Cercopam, et a Cicadarum gente alienam; nisi forte, ut marem fœminamque turturem, voluptatis gratia, caveis includerunt Græci; ita etiam masculo Cicadæ Cercopem fœmenam adjunctam fuisse statuamus," &c., which may be translated:—"Certainly the words of Lysias, 'I have never yet seen in your house, Lady, either a Cercopis, or a jay, or a nightingale, or a Cicada, or a turtle,' give us reason to suppose that the Cercopis was gifted with a voice, but

* Moufat, *l.c.*, 132. † Geor. lv. 1447; Ovid, Fast. lv. 461.

yet was different from the ordinary Cicadas, unless the Greeks shut the males and the females in cages, like turtle-doves, to note their amatory manners," &c. The argument would seem to be, either that the Cercops was the female of the Cicada, or that both were musical, like all the other animals he names.

Several elegant Greek poems are extant, often erroneously ascribed to Anacreon, who flourished about 532 B. C. These are so playfully expressed that they have found exponents, by translations into Latin and English by several modern scholars. In the 'Anthologia Oxoniensis' (p. 150) there is an Anacreontic ode to the Tettix, beginning Μακαριζομεν σε τέττιξ, which may thus be translated into English :—

We bless thee, Tettix! for, seated on the tree-tops sipping the dew, thou singest like a king. Thine are all simple things, and sufficient to thee are rural glades. All ripe fruits are brought thee. Thou art the shepherd's friend, and thou doest ill to none. O sweetest of summer prophets! honoured by mortals, thou art cherished by the Muses. Phœbus himself loves thee, and gave thee thy shrill song. Old age touches thee not. Wise child of the soil, lover of song, painless and fleshless, almost thou dost attain to the Gods!

Another ode to the Tettix, by Meleager, occurs in Edward's selection of 'Greek Anthology,' No. 178. Through the kindness of my deceased friend Mr. W. Allingham, I am permitted to print his elegantly rendered translation of this ode. The original Greek of this, and of some other classic poems, is placed in the Appendix, for the use of those scholars who delight in the original words of the old writers :—

"O Tettix! drunk with drops of dew,
What musician equals you
In the rural solitude?
On a perch amidst the wood,
Scraping to your heart's desire
Dusky sides with notchy feet,
Shrilling, thrilling, fast and sweet,
Like the music of a lyre.
O my Tettix! I entreat
Sing to the Dryads something new,
So, from thick embowered seat,
Pan himself may answer you,
Till every inmost glade rejoices
With your loud alternate voices;

And I listen and forget
All the thorns, the doubts and fears,
Love in a lover's heart may set;
Listen and forget them all,
And so, with music in mine ears,
When the plane tree shadows steep
The ground with freshness, gently fall
Into a noontide sleep."—W. A.

Before dismissing this part of my subject, which some perhaps may think already too prolix, I will add some interesting notes kindly furnished by Mr. Edmund Gosse. They must have involved some research on his part. On the title-page of this volume is inscribed an epigram of four lines made by the poetess Anytë, of Tegea, who wrote about three hundred years before our era.

In this early time Greek ladies, cotemporaries perhaps of the cruel Medea, seem nevertheless to have found room for sympathy with their pets. Mr. Gosse kindly gives me the following prose translation of these lines :—

"The Epigram of Anyte.

"For a grass-hopper, the nightingale of the fields, and for an oak-dwelling Cicada, Myro hath built a common tomb: there the maiden lets fall her virgin-tears, since relentless Hades hath torn both her pets from her!"

There is a late imitation of this by Pamphilos, about a Tettix which was thoughtlessly killed by the hand of a child, beginning, "Ουκέτι δὴ χλωροῖσιν," &c.

A beautiful and ingenious little lyric is extant, by Archias of Antioch (2nd century B.C.), about a Tettix that, seated on a branch of a pine, was singing to the shepherds, striking its feet against its sides, when it was killed by ants. The poet consoles it by comparing its fate to that of Mæonides himself! "Πρὶν μὲν ἐπι χλωροῖς," &c.

Another Byzantine Greek, Marcus Argentarius, has an epigram on Myro and her monument to the Tettix, imitated from Anytë, whose poem seems to have been the general model for such effusions. Antipater, of Thessalonica, says the dew is enough to intoxicate

Cicadas. "Ἀρκεῖ τέττιγας μεθύσαι δρόσος." Appollonidas has a pretty little poem about Kriton the Pialian, a fowler, who threw his lines over a Tettix that was singing in mid-heat of the sun, but he was rightly punished, for none of his snares would ever succeed again. It begins, "Θαμνον ποτ' ἀκρους," &c.

An anonymous epigram in the 'Planudian Anthology' describes how a spider caught a Tettix in its web, and how the poet set it free, for love of its song. "Be at liberty!" I cried, "thou who singest with the voice of the Muses."

The foregoing selection does not exhaust the list of ancient poems on the Tettix, but it may suffice for Greek quotation.

As to Latin literature we may remark that Virgil has several references to this insect, thus :—

> "Sole sub ardenti resonant arbusta Cicadis;"*

and in almost the same words he says—

> "When the querulous Cicadæ make the woods resound with their songs." †

That Virgil did not much admire their music may be gathered from his lines :—

> "The creaking locusts (Cicadæ) with my voice conspire,
> They fried with heat, and I with fierce desire."

Once more he sings :—

> "While bees on thyme and locusts feed on dew,
> Thy grateful swains these honours shall renew."‡

Lucretius seems to have believed that Cicadæ put off their tunics in summer, whence the line—

> "Cum veteres ponent tunicas æstate Cicadæ," §

and—

> "Folliculos ut nunc teretes æstate Cicadæ
> Linquunt sponte sua victum vitamque petentes."

Roughly rendered—

> "As now in summer Cicadæ spontaneously leave their tender skins, seeking new life and sustenance." ‖

* Buc. Ecl., ii. l. 13. † Geor., iii. l. 328. ‡ Buc. Ecl., v. l. 77.
§ De rerum Naturæ, Lib. iv. l. 55. ‖ Ibid., Lib. v. l. 801.

The Grasshopper is mentioned several times in our authorized version of Scripture, and is so translated from different words, which possibly are variants of a root, signifying a gnawing, swarming, or licking-up insect. But once only is its voice noted in the Bible, and then, as in Deut. xxviii. 42, it appears only to refer to the rushing noise made by thousands in their flights. There is an allusion to the insect in the well-known passage, Eccl. xii. 5, "The almond tree shall flourish,—and the Grasshopper be a burden." If the word for this insect might be translated "Cicada," the burden might well refer to its wearying song, affecting and irritating an old man.

Our English bards have not been unmindful of the Cicada, but their inspiration is chiefly drawn from classic sources, since the singing insect is so rarely met with in Great Britain. Here the same confusion often occurs with reference to the Grasshopper. Vincent Bourne some years ago wrote some elegant Anacreontic verses, "Ad Grillum," beginning one of his stanzas with "Beatior Cicada."

Cowper translates this same poem into English verse. In a similar strain Cowper apostrophizes the Cicindella and the Glowworm. With reference to the last, he gives us the playful verse,—

> "Disputes have been and still prevail,
> From whence his rays proceed;
> Some give that honour to his tail,
> And others to his head."

Cowley elegantly renders an Anacreontic ode thus:—

> "Happy insect! what can be
> In happiness compared to thee?
> Fed with nourishment divine—
> The dewy morning's gentle wine.
> Nature waits upon thee still,
> And thy verdant cup doth fill.
> 'Tis filled wherever thou dost tread,
> Nature's self thy Ganymede.
> Thou dost drink and dance and sing,
> Happier than the happiest king.
> All the fields which thou dost see,
> All the plants belong to thee;

BRITISH CICADÆ.

Genus I.—CICADETTA, *Amyot & Serville.*

Head triangular. Ocelli three, disposed in a triangle on the vertex. Frons separated by a suture. Labrum subulate. Basal joint of antenna usually covered by a scale between the eyes and the frons. Pronotum trapezoidal, anterior border straight immediately behind the eyes. Mesonotum without carination. Elytra with sectors radiating from 4-sided basal cells. Apical cells eight. Rostrum reaches beyond the third coxæ to the middle of the sternum. Stridulating organs situated on the first abdominal segment of the male. Anterior thighs with three spines. Pulvilli absent.

Cicadetta montana. Plate 1, figs. 7 to 15.

Cicadetta montana, Scop., Hagen, Stett., Kirsch.
,, *hæmatodes*, Linn., Germ., Fieb.
,, *tibialis*, Latr.
,, *orni*, Sulz.
,, *anglica*, Leach, Saml., Curt., Westw., Marsh.
Melampsalta montana, Sahlb.
Cicadetta montana, Fieb. Cicad. d'Europe, pt. ii., 79, Edw. 45.

	Inches.	Millimètres.
Expanse of wings	1·95	50·69
Size of body	0·81×0·22	21·00×5·58

General colour dark brown, with fine yellowish almost scale-like hairs. Head broad, tumid between

the eyes. Ocelli 3, disposed in a triangle. Eyes reddish and prominent. Antennæ short, the larger basal joints springing from fossi or pits, the other joints forming a tapering seta. Crown triangular, with a deep transverse line in front. Pronotum with two fine parallel straight lines. Disc with three strongly impressed lines on each side. Elytra clear, nerves black, costal and basal nerves yellowish red and stout. Front femora with three teeth. Clypeus trapezoidal, more or less barred with brown. Labrum short and tongue-shaped. Labium mostly concealed by the clypeus. Proboscis, with its three setæ, reaching to the third coxæ. Pro- and meso-thorax long, upper part raised into several tubercular masses. Scutellum trigonate and inconspicuous; "two closely placed parallel fine straight and raised lines down the middle in front" (Edwards). Abdomen robust, conical, composed of from six to eight somites, rapidly tapering to the pygofer, which bears the genitalia. This part is horizontally cleft in the male, but contains the valves and ovipositor of the female insect. Anal tube black, with the tegumentary scale in the male covering the penis with its prehensile hooks. Last ventral segment elongated. The male has two large semi-lunar valves close to the meso-sternum, which cover the sounding organs. Elytra deflexed when at rest, long-pointed, and furnished with strong costal ribs. Membrane brownish and hyaline. Apex limbated, such margin ending at the point of the clavus. Basal area of corium oblong; apical cells normally, but not constantly so; subapical cells five. Wings with six apical and three basal cells. Legs short and robust. Front femora flattened, and furnished with three teeth. Tarsi short, tri-articulate, and without pulvilli between the claws.

The general colour of the British insect is rich brown. Costa, wing-insertions, legs, edges of the abdomen, and pygofer reddish yellow. The legs of the Haslemere specimen I possess, are all finely barred with brown, and the body sparsely covered by delicate

scale-like hair. The males are smaller than the females.

It might have been expected that the male stridulating organs would have been supplemented by obvious auditory organs in the female. No such apparatus has yet, however, been found in this sex. It can scarcely be doubted that she is interested in her mate's monotonous screeching; but the mode in which insects appreciate sound, to biologists is yet doubtful.

Perhaps *Cicadetta montana* is the most northerly species of the stridulating Cicadæ. *Cicada sanguinea* of Fabricius, with which it was long confounded, is a larger and different insect, and has not been noted in Great Britain.

The first notice of *Cicadetta montana* occurred in the year 1812, when it was captured in the New Forest by Mr. Dale. Curtis searched the same spot afterwards for several consecutive years without success; but eventually he secured three specimens on the 2nd and the 7th of June. He describes the males as flying like humble-bees, and says that when beaten into furze bushes or other cover they buzzed like dragon-flies.

The winged insect affects both the willow (*Salix*) and the whitethorn (*Cratægus*); but as the pupa has only once been discovered fixed to a plant, *viz.*, to the frond of the common brake (*Pteris aquilina*), it is probable that this fern forms its natural food. (*Vide* notice by Mr. Weaver, Mag. Nat. Hist., No. 29.)

The larva is supposed to burrow two or three feet in the ground during the winter, and to rise to the surface on the return of warm weather.

Neither Dale nor Curtis could prevail on their insects to sing; but probably fresh air and sunlight are necessary to provoke their singing powers. As the drums are well developed in the British insects, there seems to be no good reason why they should not be musical, like others of the same genus. This opinion is shared by Kirby and Spence, who indeed say that the insect is noisy.

The complicated saw-structure operates on the bark of the feeding-plant, and produces therein the channels for the reception of the eggs, in the manner showed long ago by Réaumur.

I possess the remains of a male specimen, captured by Mr. C. Barrett in Frillinghurst Wood, two or three miles out of Haslemere. It is interesting, as furnishing a second habitat in the British Isles, but hitherto I have failed to obtain other specimens from the same locality.

These insects appear to be very shy; and I am informed that any attempt to approach them whilst singing, at any rate on the Continent, has the effect of suppressing their music for a time.

In June, 1877, Mr. Gulliver captured a fine male *Cicadetta* at Brockenhurst, in the New Forest. I am told by Mr. I. Anderson that it betrayed itself by a loud stridulation. This fact puts at rest the question of the British insect's powers of song. Mr. Tait, again, in 1881, captured a larva of *Cicadetta montana* in June, at Lyndhurst, New Forest, from which he successfully reared the imago, about the middle of the same month. (Ent. Mo. Mag. xviii. p. 40.)

Probably this insect is not so rare in Britain as has been generally supposed. Undoubtedly it is localised; and must be sought for at particular seasons. Thus, in 1887, Mr. Gulliver caught eight individuals on one afternoon at Brockenhurst, and four others subsequently. Some of these specimens were possessed by Mr. J. Weir, who stated that out of twelve individuals he examined, only one proved to be a male. In 1888 I also obtained four more specimens from the same place, one only of which is a male.

Both of the accomplished American entomologists, Mr. S. H. Scudder and Mr. C. Riley, have studied the notes of various insects, with reference to their musical pitch. Mr. C. Riley thinks that this pitch varies with the density and temperature of the air.

The following notes refer to the noise made by the

remarkable periodic Cicada, *Cicada septendecim*, whose ravages fortunately are unknown to us in England. Prof. Riley compares their noise to a compromise between the distant sound of a threshing-machine and the din of a croaking frog-pond. The common note may be imitated by a pronunciation of the letters, "Phar-r-r-r-aoh," and continued for perhaps three seconds. Then there is a louder call, nearer to a screech, "Tsh-e-e-e-ou." This is taken up, in unison, by the numerous males around, and the effect is deafening. There is yet a third sound, which consists of from fifteen to thirty sharp chirps, which somewhat recall the notes of the chimney-swallow. (See 'Science,' Sept. 25th, 1885. Vol. vi.)

A remarkable point in the economy of this American *Cicada* is the curious erect earthern tubes it constructs above the ground, within which the insect undergoes its transformation into the imago.

II.—MEMBRACIDÆ, Stål.

Crown almost vertical. Ocelli two, on the crown. Frons much deflexed, and nearly horizontal. Tegulæ wanting. Hind coxæ transverse, reaching nearly to the sides of the sternum. Tibiæ prismatic. Posterior femora unarmed above. Elytra with many cells; apical cells five.

The British known species may be divided into two genera, the general characters of which may be thus tabulated :—

	Centrotus.	Gargara.
Head.	Punctured.	Black, punctured, shining.
Pronotum.	With a horn on each side. Hind process bisinuate, not concealing the scutellum.	Without side horns. Hind process straight, and hiding the scutellum.
Abdomen.	Black, shining, punctured.	
Elytra.	Rough, fusco-hyaline, with brown nerves and a fuscous spot on the fifth apical cell.	Yellowish brown, with yellow pubescence. Nerves darker.
Wings.	Hyaline, with brown veins.	Membrane of the elytra "grossièrement bosselée" (Fieb.).
Tibiæ.	Reddish yellow; edges of third pair with black setiferous granules.	Brownish.

Genus II.—CENTROTUS, *Fab.*

But one species of this genus is known in Britain.

Centrotus cornutus, *Linn.* Plate II., figs. 1 to 7.

Cicada fusca, DeGeer, tab. 11, fig. 22.
Cicada cornuta, Scop., Linn.
Membracis cornuta, Fab., Panz., Geoff.
Centrotus cornutus, Burm., Marsh., Sahl., Fieb., Cicad. d'Eur. pt. ii. 10; Edw. p 47.

Antennæ with two basal joints, and a third longer joint furnished with a seta. Frons nearly straight. Ocelli two, but not easily seen behind the yellow pubescence which clothes the face and head. Pronotum trapezoidal; the hinder portion produced nearly to the tail into a horn-like process, of varying diameter. A suture extends throughout its upper edge to the junction with the head. A much blunter horny expansion, on each side, extends far over the wing-insertions, and partly conceals the scutellum. Viewed sideways, the scutellum may be seen under the dorsal horn. Elytra rufous by ordinary light, but bright bronzy by glancing light. Apical cells five. Femora with annuliform dots.

The female has the last ventral segment deeply notched. The male has no genital valve; laminæ connate, with a convex appendage, the two last abdominal segments being carinated in the middle.—Sahl.

This insect viewed from the front has a grotesque appearance, somewhat resembling a face surmounted by horns. The fancy of the French peasant has, like that of other countries, united the solemn to the hideous, and has found in this insect a Mediæval likeness to "the great Accuser." Geoffroy, De Geer, and Réaumur note that this insect in their days was, as now, popularly called "le petit Diable."

The distribution of *C. cornutus* is wide. It extends

throughout the milder parts of Norway, Sweden, Russia, and even into parts of Siberia. It is known in Holland, and very generally inhabits the woods of Central Europe. Dr. Puton adds to these localities Central France and Spain.

Though so generally diffused, this insect is nowhere very plentiful in England. I have examples from Huddersfield, Norwich, and Brockenhurst in the New Forest, Hants. From this last place I received, however, more than twenty specimens in one summer.

Fieber describes another species from Southern France, viz., *Centrotus chloraticus*. He notes but three genera under the tribe *Centrotides* of Stal, *viz.*, the two above mentioned and *Oxyrhachis*, Germ.

Fieber describes eight varieties of Continental *Centrotus cornutus*.

Genus III.—GARGARA, *Am. & Serv.*

But one species of this genus is known in Britain.

Gargara genistæ, *Fabr.* Plate 2, figs. 8 to 11.

Centrotus genistæ, Fabr., Panz., Curt. Brit. Ent. Pt. 513.
Oxyrhachis genistæ, Burm., Flor., Marsh.
Gargara genistæ, Kirsch., Fieb. C. E., pt. ii. 16; Edw. 48.

This rare insect is considerably smaller than *C. cornutus*, with which it has been confounded. It has no distinct horns on the sides of the pronotum; but the straight middle process conceals the scutellum. Head and thorax black and punctured. The greater part of the insect is covered by a yellow pubescence. Elytra rather short, brownish, iridescent, with darker nerves. Eyes greyish. Femora black. Tibiæ prismatic and not flattened; tarsi equal.

Mr. Edwards gives Purfleet, Essex, and Chobham, Kent, for its habitats. Its food-plant is *Genista tinc-*

toria and *G. anglica*. It does not occur in Sahlberg's List of Swedish Cicadariæ.

The specimens drawn in my plate are from the cabinet of J. W. Douglas, Esq.

Length 3·00 millimètres, or 0·12 inch.

FULGORINÆ, Stål.

Two ocelli on the cheeks, and sometimes a third at the extremity of the frontal mid-carina. No stridulating organs. Anterior thighs not thickened (*non renflées*, Fieb.). Tegulæ at bases of elytra small. Elytra either hyaline or parchment-like. Neuration often complex and indistinct. Limbus none. Posterior tibiæ with numerous spines.

Burmeister, and more recently Sahlberg and Fieber, divided the Cicadidæ into families, of which the former author named the Fulgoridæ the third, and Sahlberg the fifth, in their several systems. Mr. Edwards, in his 'Synopsis' (the arrangement of which I have very generally adopted in this Monograph), does not formally include British forms under the head Fulgoridæ; but places *Cixius* and *Delphax* under sub-families designated by their respective names.

Burmeister probably gave the name *Fulgora* to the exotic lantern-flies, as suggestive of the luminous property then popularly believed to reside in the singular horny cases protruding from their thoraces, which have fanciful resemblances to Chinese lanterns.

Notwithstanding Madam Merin's well-known circumstantial statement, "that she could read the print of a Dutch newspaper by the light afforded by one of these insects," no reliable Entomologist has confirmed her statement of such a phosphorescence. A writer, however, in the 'Ent. Month. Mag.' (vol. viii., p. 167) calls attention to a statement made in Perry's 'Arcana' (an old book), doubtless on hearsay evidence, that

the attendants on travellers in China are in the habit of lighting their ways at night by carrying one *Fulgora candellaria* on the foot, and another in each hand.

The Editors of the above Magazine hint that "if *Fulgora* be luminous, then it must studiously turn off its 'bull's eye' in the presence of all the modern scientific naturalists who have made special search for its lamp; and having arrived at this stage of development we anticipate that, by a process of natural selection, *Fulgora* will eventually lose all luminous power and attributes, having found no (?) truth in the motto "ex luce lucellum."

Though much has been written on the cause of luminosity in insects and fish, the interest is yet fresh, and much remains to clear up certain points. There is no *a priori* reason against a Cicada showing luminous properties, and negative evidence is but slight proof against positive assertion.

On account of the interest in this subject I may quote some of Dr. Dubois' observations. He has lately studied the subject of insect luminosity. So far as concerns the phenomenon in the American *Pyrophorus noctilucens*, he states that the light is not brought into play by mere oxidation of matter in the luminous organs. Pure oxygen gas does not increase the light, neither is it affected by moderately compressed air. He seems to think that the light is useful for the insect's guidance; for if the organs on one side are obscured by a black wax, the insect walks in a curve toward the side still illuminated. If the light from both sides be quenched, he says the insect seems to be puzzled, and that the ground is felt doubtfully with the antennæ. The light has a peculiar spectrum, and as it is said to affect silver salts it is probably rich in chemical rays. As in other insects, the organs continue to shine long after the death of the insect and their separation from the body.

It is even stated that the phosphorescence is not destroyed by drying; for these parts may be powdered,

during which operation no light appears, but it is immediately evoked by moistening the powder with water.

Dr. Dubois thinks that the action is more of a chemical than of a nervous nature,—that is, action evoked by nervous excitability,—and that an albumenoid substance exists which is acted on by a matter belonging to a chemical diastase group, during the combination of which secretions, light is liberated. (*Vide* 'Ent. Month. Mag.' vol. xiii., p. 143; also 'Nature,' vol. xxxiv., p. 578.)

Some Fulgoridæ attain to considerable dimensions in semi-tropical countries, but in Northern Europe they are represented only by comparatively small, yet numerous, species. Probably *Issus* is the largest representative yet known in Britain.

III.—TETTIGOMETRIDÆ.

Numerous in Central Europe, but represented in Great Britain by only a single species.

Genus I.—TETTIGOMETRA, *Latr.*

Easily recognised by the peculiar form of the antennæ, and the position of the seta upon it. Also by the horny and punctured elytra, rising from distinct tegulæ. "Face ptyloid."—*Edw.*

Tettigometra impresso-punctata, *Sign.*
Plate III., figs. 10 to 12.

Tettigometra impresso-punctata, Sign., Marsh, Fieb. C. E., pt. ii., 130; Edw., p. 48.
T. frontalis and *T. fasciata*, Fieb.
T. nitidula, Kirschb.

Face without keels or carinæ, swollen. Antennæ placed near the base of the eyes, and just under the ocellus, which last is situated at the inferior margin of the eye. First antennal joint half the size of the

second, the seta being placed at the hinder edge of the same. Elytra large, with fuscous nervures. Tibiæ with two rows of bristles. Colour greenish brown. Anterior margin of the head produced into a blunt triangular apex. Inferior margin of the pronotum truncated, for the attachment of the tegulæ. Elytra much punctured and elaborately netted; apical veins seven, without any limbus.

This genus is scattered over a great part of Europe, from whence Fieber notes thirty-two species. It is not common in England; but I have specimens from Shiere, near Guildford, which were beaten out of yew trees (*Taxus baccata*) in February, by Dr. Capron, where they seem to have hybernated. They also have been taken on *Juniperus communis* in September. To the above habitats Mr. Edwards notes sandy soils, Freshwater Bay, Isle of Wight, and Folkestone Warren, from a root of *Teucrium* in August.

Length 4·50 millimetres, or 0·157 inch.

Fieber notes two varieties, viz. *concolor* and *fasciata*. He describes the male as living in woods on the "buissons," and in grass. He names twenty-seven European species.

IV.—ISSIDÆ.

Ocelli wanting. Pronotum hardly larger than the head; hind margin nearly straight. Tegulæ obvious and large. Hind tibiæ with two strong spurs on the lower half; tarsi armed with spurs.

Genus I.—ISSUS, *Fab.*

Only represented in Britain by one species.

Issus coleoptratus, *Geoff.* Plate III., figs. 1 to 7.

Fulgora gibbosa, Oliv.
Cicada coleoptrata, Geoff.
Cercopis coleoptrata, Fab.
Issus coleoptratus, Fab., Germ., Am. & Serv., Fall., Curt. Pl. 449, Marsh., Kirschb., Sahl., Fieb. C. E., pt. ii. 253; Edw. 49.

Body very broad. Elytra angularly dilated towards the middle of the costal edges. Ocelli none. Head and eyes narrower than pronotum. Outer edges of hind tibiæ with two spines on the lower half. Very variable as to colour and markings. General tint dull green, or else leaden grey, with black reticulations. Head and pronotum small and narrow. Abdomen much dilated. Elytra short and rounded, so as to show some resemblance to a *Coccinella*, whence its beetle-like name. Colour greenish, with numerous cross-veinings and reticulations; limbus absent. First antennal joint pyriform; second small and globular, ending in a black seta. Pygophore complex. Hind tibiæ dilated at the tarsal end, and spurred.

The male is smaller than the female, and usually of a brighter colour.

Plentiful near Shiere, Godalming, and at Brockenhurst. It is pretty generally distributed also over the South of England.

	Inch.	Millimètres.
Expanse of wings	0·62	15·0
Body	0·280×0·170	7·00×4·3

Pupa honey-yellow in colour. Frons very tuberculate, and covering almost the entire face below. Clypeus black. Eyes black. The head and entire pronotum cut up longitudinally and transversely by strongly-marked carinæ. Anterior part of pronotum and the spaces behind the wing-covers studded with circular tubercles. Abdomen strongly ringed and marked by a dorsal carina.

Legs short and stout. Anal segment, seen from behind, scutiform.

	Inch.	Millimètres.
Size	0·16 × 0·12	4·06 × 3·04

This insect, taken at Forres, Morayshire, Scotland, is so different in form from the imago of *Issus coleoptratus* that, except from the rudimentary wings and partially developed pygofer, it might be regarded as specifically

distinct. In many aspects it answers to the description of *Issus truncatus*, Fieb.; but I agree with Mr. Douglas, who kindly examined the insect, that it has the characteristics of a pupa, and thus I leave it under the name of the ordinary species.

V.—CIXIIDÆ.

The relation of the Cixiidæ with the Delphacidæ may be seen in the forms of the face, with its raised keels or carinæ, and the reticulations of the wings. There are, however, differences of structure as regards the processes attached to the genitalia of both sexes. These processes on the pygophore of *Cixius* project laterally beyond the end of the genital segment. When the styles of the male can be dissected out, data are available for the diagnosis of the species. Mr. J. Scott makes out ten British species, but Mr. J. Edwards has recently reduced these to nine.*

Highly developed insects are commonly furnished with wings having a complex venation. Thus the *Cicadidæ* and *Cixiidæ* are contrasted with the simpler Typhlocybidæ, whose elytra show far plainer characters in neuration. This complex netting in the former group suggested to Kirschbaum the descriptive term Dictyophoridæ, from δικτυον and φερεω.

The Cixiidæ are numerous in the hotter parts of the world, and interest attaches to many of them from their secretions of silky and waxy matters. Many Homoptera elaborate these products from special glands situated within the abdominal rings; notably the Cocci and Aphides; and amongst the Cicadidæ, some of the British Cixiidæ.

Mr. A. C. Morgan considers that the often beautifully arranged waxy plates and threads which cover some Coccidæ proceed from organs relating to the intestinal or digestive system, and he thinks that they represent

* Vide Trans. Ent. Soc., 1886, p. 41; also Ent. Mo. Mag., October, 1888, p. 100.

the ventral salivary glands, noted by Burmeister.* Amongst the Aphides these silky flocks are insoluble in alcohol, and have a composition somewhat analogous to silk. But the products from the large foreign Cixiidæ and Flatidæ are distinctly of a crystalline waxy nature; and such a material forms one of the varieties of the Chinese wax of commerce known as *pela*.

The general characters of the Cixiidæ are as follow :—

Ocelli two or three, and placed on the frons, halfway from the apex. First joint of the hind tarsi with no spur at the base. Nervures much divided in the elytra, and often studded with setigerous bulbs or granules. Body wide and depressed. Head small, and, taken with the eyes, distinctly narrower than the pronotum. Ocelli placed on the sides of the head, with the indication of a third near to the apex of the facial keel. Elytra and wings ample, hyaline, and rounded at the apices. First joint of the hind tarsi elongated.

The British genera are divided by Stal and Sahlberg into insects furnished with five keels on the scutellum (*Oliarus*), and insects with three keels thereon (*Cixius*).

Although the British species are few, they are not easy to separate with sharpness one from the other; hence the somewhat doubtful character of their diagnosis, and their involved synonymy. An adequate study of foreign forms will greatly help to decide between specific and merely sporadic varieties. These last often materially differ amongst themselves in markings and colour from the normal forms.

Mr. Edwards has lately made an attempt to tabulate the "essential characters" of our English species. His scheme is based in great measure on the size,

* Also "Observations on Coccidæ, No. 3," by Mr. Albert C. Morgan, Ent. Mo. Mag., January, 1889. p. 189.

number, and position of the costal granules of the elytra. Though this is a convenient help to the identification of species, it can hardly be looked upon as Natural; and indeed it is not claimed by him to be such. However, when a species has been once proved, we may, for general purposes and convenience, fall back upon such external characters.

For the like assistance I also tabulate certain characters, the scheme being based on Mr. James Edwards' plan.

The wings of the Cixiidæ appear to have an expansion beyond their apparent need as flying organs. They may be regarded more as means for suspension than for progression in the air. With the exception of *Oliarus*, all the British species are granulated on the nervures. The elytra, when at rest, are folded horizontally, and parallel to each other; and then the insect has much the appearance of a minute moth, shaped like a *Noctua*.

The wings have no limbus, and their nervures are not spotted. The disposition of the venation is pretty constant throughout the species, but, as shown in my Plates, the right and left wings do not always correspond. Less material specific characters may be sought in the colours of the face or mask, which lies prone or horizontal to the ground, when the insect walks.

The female ovipositor consists of two serrated plates enclosed in an open sheath, which is again supported between two horny valves, the five parts together forming a single tube, which is very evidently seen when viewed from above. These terminal parts are commonly covered by a cottony or a waxy mass. Fieber says the abdomen in *Cixius* "est exceptionellement tronqué et porte dans ce cas chez la femelle, un façeau de flocons crétacés."

The two genera may be thus separated:—

Oliarus.	Scutellum with five carinæ. Ocelli three. Elytra without bands or neural spots.
Cixius.	Scutellum with three carinæ. Ocelli two. Elytra with dark bands and neural spots.

Genus I.—OLIARUS, *Stål.*

Head with eyes distinctly narrower than the pronotum. Ocelli two on the sides of the head, near the lower margin of the eyes; with a third ocellus near the middle frontal keel. Pronotum very short, strongly notched laterally. Side keels somewhat circular. Scutellum very large, comprising the greater part of the thorax. Tegulæ small, but distinct. Abdomen large and depressed, rounded at the apex, and provided with a blunt style. Anal tube in the male subfoliaceous, dilated at the sides, and bent into an arch, "fornicato-deflexis" (Sahlberg).

Oliarus pallidus, *H.-Schaff.* Plate IV., fig. 1.

Flatta pallida, H.-S. Deuts. Ins. 144, 4.
Cixius leporinus, Curt.
Oliarus pallidus, Scott, Fieb. C. E., pt. ii. 197; Edw. 50.
,, *leporinus*, Sahl.

Crown and vertex about one and a half times as long as broad, its breadth being less than the length of the hind margin of the eye (Edwards). Pronotum black, with five pale keels. Elytra hyaline, without either bands or spots; rounded at the tips, and provided with sub-horizontal nerves, strongly raised. Angular nerves almost black.

Curtis first noted this insect in his 'Brit. Ent.' 673, and he recorded its abundance on coarse grass, by the side of the River Avon, near Clifton. Mr. Dale captured the insect whilst sweeping grasses on downs

near Marley Wood, at Lulworth, and afterwards in the Isle of Purbeck, and at Ryde, Isle of Wight. Time of appearance, June and July.

The narrow head and yellowish elytra will easily separate this species from the next. My figure is from the cabinet of Mr. J. W. Douglas.

Length, with wings closed, 5·08 millimètres, or 0·220 of inch.

OLIARUS LEPORINUS, *Linn.* Plate IV., figs. 2 to 4.

Cicada leporina, Linn., Schr., Panz.
Flata pallens, Germ. *F. leporina*, Germ., H.-Schf.
Pentastira leporina, Kirschb.
Oliarus leporinus, Scott, Fieb., C. E., pt. ii. 203; Edw. i. 51.

Large, general colour blackish, with reddish keels and eyes. Crown broader than long. Contour of head, with eyes, somewhat circular; together narrower than prothorax. A transverse keel occurs between the eyes. Frons yellow. Elytra clear and hyaline; stigmatic patch marked. Nervures brown on a fuscous membrane. Scott says "finely granulated," but I could not see any such punctuation on the specimen lent to me. Scutellum large and black, with five dark raised keels. Anal tube of the male yellow, with a brown dorsal streak, lanceolate, and obliquely truncate behind. A triangular lobe at its extremity.—(Fieber).

The figure on my Plate is from a specimen taken by Mr. E. Saunders, in August, on the Tamarisk (*Tamarix gallica*), at Herne Bay. The same Entomologist also captured specimens at Deal, in June, on the same plant.

A larger specimen was lent to me by Mr. Douglas. Fieber says that the insect is scattered over the greater part of Europe, but its appearance in Britain has been rarely recorded.

	Inch.	Millimètres.
Expanse	0·420	10·56
Body with wings	0·150	3·83

Fieber names eighteen European species of *Oliarus*.

Genus II.—CIXIUS.

Antennæ short; second joint nearly globular. Ocelli two. Head, with eyes, narrower than pronotum, which last is short and notched behind. Elytra hyaline. Nervures studded with setigerous granules.

First joint of hind tarsi elongated. The first and second radial veins of the elytra forked before the extremity, and connected by a transverse vein, near the bifurcation of the radials. Anal tube of the male semi-cylindrical. "La tarière de la femelle longue, en forme de sabre."—(Fieber).

Cixius nervosus, *Linn.* Plate IV., figs. 5 to 9.

Cicada nervosa. Cicada cunicularia, Linn.
Flata nervosa, Germ., Fab., Fall.
Cixia nervosa, Burm.
Cixius nervosus, Schäff., Zett., Marsh., Kirsch., Scott, Fieb., C. E. pt. ii. 176; Edw. i. 54.

This is one of our largest and commonest species. Frons black; clypeus dark on the upper side, and yellow between the keels. Pronotum black, with reddish between the raised keels. Abdomen black, with segmental fuscous edgings. Elytra without any broad transverse band, but usually with a stigmatic streak, and another faint one from the basal half of the costa. Spots on the costa larger than on the other nervures. Spots more than ten, and mostly united into threes and fours. Nervures yellow. Stigma brown. Legs fuscous.

Male anal tube black; cylindrical when seen from above, but showing two strong processes from below. The female is well furnished with cottony flocks.

Obtained by beating shrubs and trees in June and September.

	Inch.	Millimètres.
Expanse	0·510	12·70
Size of body	0·150	3·81

CIXIUS STIGMATICUS. Plate V., figs. 1 to 6.

Flata stigmatica, Germ.
Cixius musivus, Marsh.
,, *distinguendus*, Kirsch., Sahl.
,, *stigmaticus*, Scott, Fieb., C. E., pt. ii. 183; Edw. i. 52.

Between the keels of the clypeus black. Pronotum and scutellum black. Tegulæ reddish. Elytra all dark grey or fuscous-brown, with darker stains. Nervures whitish, with no broad apical band. Costal spots large, and more than ten. Stigma marked. Abdomen black. Female with cottony tufts. Legs all yellow; tarsi black.

Inverness, Deal, Isle of Wight, Norfolk. Taken on *Hippophaë rhamnoides*.

The dark insect on my plate is from Mr. J. W. Douglas's cabinet. That with expanded wings was taken by Mr. Edwards.

	Inch.	Millimètres.
Expanse	0·62	16·00
Body and wings	0·215	5·35

CIXIUS CUNICULARIUS, *Linn.* Plate VI., figs. 7 to 11.

Cicada cunicularia, Linn.
,, *nervoso-punctata*, De Geer.
Flata cunicularia, Fab., Germ.
,, *nervosa*, Fall.
Cercopis dionysii, Panz.
Cixia cunicularia, Burm.
Cixius dionysii, Curt. Brit. Ent. (plate 673).
,, *nervosus*, Kirsch., Flor., Marsh.
,, *cunicularius*, Scott, Sahl., Fieb., C. E., pt. ii. 181; Edw. i. 53.

Head brown, with yellow between the keels. Scutellum lozenge-shaped, dark brown or black. Abdomen broad and flat, the second and last rings being furnished with flocculent matter. Legs long. Clypeus and keels yellow, but sometimes the upper half is suffused with brown. Rostrum long, reaching just beyond the third coxæ. Elytron with a broad brown bar, about one-third distant from the apex; with a greyish spot exterior to this bar. Membrane slightly fuscous. These markings, however, are not constant in form. Main nervures yellowish, with numerous granules. A reddish variety, with a pale spot before the stigma, constitutes the *C. dionysii* of Curtis.

Widely distributed. Perth, Newcastle-on-Tyne, Wootton, Surrey, Sussex, &c.

	Inch.	Millimètres.
Expanse	0·500	12·70
Body	0·180	4·56

Cixius brachycranus, *Fieb.* Plate V., figs. 7 to 10.

Cixius intermedius, Scott. For male styles see Ent. Mo. Mag. vii. 147, fig. *g*.

Cixius brachycranus, Scott, *l. c.* p. 193. Fieb., pt. ii. Cicad. d'Eur. 179, 9; Edw. i. 54.

Crown twice as broad as long. Elytra hyaline; with the base, the angular nerves, and a straight band somewhat before the middle, fuscous. Granules black, stigma piceous. Face and legs entirely brownish yellow, (Edwards). Scott says smaller than *nervosus*, to which it is related. The squarish shape of the granules, the colour, and the form of the genitalia are the most conspicuous characters by which this insect may be known.

Newcastle-on-Tyne, Penzance, Tunbridge Wells, Foxley Wood, Norfolk. August and September.

Size 7·62 millimètres, or 0·30 inch.

Although Scott names *C. intermedius* and *C. brachicranus* as two separate species, he says that he is

somewhat sceptical as to their being really distinct. With Mr. Edwards I regard them as varieties of the same species.

CIXIUS PILOSUS, *Oliv.* Plate VI., figs. 1 to 6, and Plate VII., figs. 1 to 5.

Fulgora pilosus, Oliv. Enc. Meth. vi. 575, 41.
Flata contaminata, Germ.
,, *albicincta*, Germ.
,, *cunicularia*, Fall.
Cixius contaminatus, Flor., Marsh., Scott, Kirschb., Sahlb., Fieb., C. E., pt. ii. 170; Edw. i. 52.

General colour pitchy brown, with rufous edges to the abdominal segments. All keels and carinæ yellowish. Costal granules scarcely larger, or not larger, than those on the nervures. Three darkish triangular spots on the costa, in addition to those on the stigma. The apical part of elytra more or less suffused with brown streaks. Upper part of clypeus brown between the keels; the rest yellow. Legs brownish yellow. Anal style large and covered by cottony flocks.

The var. *C. albicincta* is much smaller, and is characterized by a broad band of brown occupying the marginal half of the wing. Two conspicuous yellow lobes occur at the base of the anal style, and the nervures are deeper yellow, with fine punctures.

The differences between the markings of this insect and the normal *C. pilosus* appear to me to be greater than between some species, but I prefer to accept Mr. Edwards' opinion that such variations are scarcely specific. Nevertheless I have introduced figures of *C. albicincta* into my plate, with its genitalia.

C. pilosus is perhaps our commonest species. Mr. Mosley has kindly sent me many examples from Huddersfield. The insect is generally spread over southern Europe and the counties of England.

	Inch.	Millimètres.
Expanse	0·400	10·16
Body	0·140	3·55

CIXIUS SIMPLEX, *H.-Schäff.* Plate VII., fig. 10.

Flata simplex, H.-Schäff., Nom. Ent. 164 (1835).
Cixius distinguendus, Kirschb.
,, *simplex*, Scott, Fieb.
,, *Scotti*, Edw., Ent. Mo. Mag. xxv. p. 160,

Head and pronotum black. All keels brownish yellow. Frons and clypeus black, with yellow carinæ. Elytra milky hyaline; nervures delicate and finely punctured. Dots eye-shaped (Edw.). Apex of claval suture and a streak on the inner margin black. Thighs black; tibiæ yellow, with a dark stripe. Apical lobes of styles obovate; their stalks short and spreading outwards.

In great measure the above is Mr. Edwards' diagnosis. This insect has been rarely taken in England, and to the above gentleman I am indebted for the means of figuring it.

Mr. Edwards has recently revised his List of British Cicadinæ in the Ent. Mo. Magazine. He there states that *C. simplex* of H.-Schaff. is not the insect so called by Scott; but he does not clearly show in what the difference consists. He proposes to call his new insect *C. Scotti*, but as no specimens available to dissection have come into my hands, I still provisionally call Scott's insect *simplex*. One character given for *C. Scotti* is, "Costal granules twelve to fourteen, occupying the whole width of the nerve;" but in the example lent to me there appear to be more than these numbers.

	Inch.	Millimètres.
Size of body with wings	0·240	11·14
,, body	0·196	4·82

CIXIUS SIMILIS, Plate VII., figs. 6 to 9, Kirschb.

Scott, Fieb., C. E. pt. ii. 185; Edw. pt. i. 54.

Head, pronotum, and scutellum black or dark brown; carinæ pale brown. Elytra with brown membranes,

and obscurely mottled. Costal granules variable in number, and rather larger than those on the other nerves. Nervures indistinct, mostly indicated by minute rows of dots. Stigma indistinct. Legs yellow. Frons and clypeus black, with yellow keels.

Habitat.—Woking, Hastings, Bonchurch. Mr. J. W. Douglas captured this insect on the sallow thorn (*Hippophaë rhamnoides*), a shrubby plant growing on the sea-shore at Deal, and in other places. I also have three examples from Brockenhurst, in the New Forest, Hants.

Expanse, 11·48 millimètres, or 0·450 inch.

The similarity between this insect and *C. simplex* is great, but there is a difference in the opacity of the elytra. The form of the styles, as drawn by Scott, does not appear to me to differ much, and such a variation in shape might be due to a different aspect of view.

Similar remarks may be made as to Mr. Edwards' proposed new species, *C. remotus*, the diagnosis of which seems little to differ from that he gives of *C. similis*, Kbm., save in the costal spots, nine or ten, against eight to ten ; and elytra lacteo-hyaline, against pale brown. But one example at the date of his Synopsis seems to have come under Mr. Edwards' observation.

The antennal setæ of Cixiidæ are very short, and do not project much beyond the eyes. Sometimes, in the figures I have drawn, they appear too long for strict accuracy.

As a general help towards the discrimination of species, a Synoptical Table is appended. It has been constructed mainly on the lines of Mr. Edwards' scheme ; but I do not look on it as a natural, but only as a convenient, mode of grouping these insects.

SYNOPSIS OF THE BRITISH CIXIIDÆ.

CIXIUS.

- Costal granules equal to, or hardly larger than, nerve granules.
  - ... ... *pilosus.*
- Costal granules larger than those on other nerves.
  - Nerve granules roundish.
    - Costal granules more than 10 ... ...
      - Elytra with broad fuscous band from stigma to near margin of spot at apex. ... ... *cunicularius.*
      - Elytra without transverse band from stigma. ... ...
        - Anal tube with two recurved horns at the apex... ... *nervosus.*
        - Anal tube without horns. ... ... *stigmaticus.* *bruchicranus.*
    - Costal granules, 8 to 10. ... ... *sivulis.*
  - Nerve granules oblong.
    - Costal granules, 12 to 14. ... ... *simplex.*
    - Costal granules, 9 or 10. ... ... *remotus.*

DELPHACIDÆ.

The British Delphacidæ number more than fifty species, many of which are minute, and to the casual observer show similarities one to the other, both in form and in colour. In a general manner they may be separated from other subfamilies by the forms of their antennæ, by the ocelli being placed on the cheeks, and by a curious leaf-like spur attached to the lower part of the hind tibiæ.

Dr. Fieber, with great sagacity, studied the varying forms of the styles and adjuncts to the pygofers of different species, and his observations go far to show that these characters are sufficiently permanent to allow of specific discrimination. Mr. J. Scott and Mr. J. Edwards think, indeed, that to these general characters must be the final appeal in difficult diagnoses. These styloid appendages in the males act chiefly as claspers, and they may be regarded as secondary sexual organs. Variation in these secondary characters has been generally ascribed almost exclusively to the males; but in the Delphacidæ, Deltocephalidæ, and other subfamilies of Cicadidæ, modification occurs in the females; as may be seen in the different forms of their saw-like ovipositors and sheaths.

John Hunter first designated as "secondary sexual characters," the wattles of the turkey, the comb of our poultry-cock, and the like, as being mere appendages, and not subservient to the act of reproduction. Appositely, Mr. Darwin has stated his conviction of the importance of a rule, which he says is capable of large generalization, that parts extravagantly, that is extraordinarily, developed in animals are highly variable; and also that the species of a large genus which present any variation, invariably present a larger average number of them than do the species of a small genus. Geoff. St. Hilaire appears also to decide that the more an organ differs in the various species of a group, the more subject it is to anomalies in individuals. From

such and other considerations, Mr. Darwin and Mr. Wallace raise arguments, that species are only strongly marked and permanent adaptations, and that community of descent is necessarily implied in the word variety. (See 'Origin of Species,' p. 120.)

But although Dr. Herman Müller once counted thirty-five distinct variations in two hundred flowers of *Myosurus minimus*, he did not doubt that his specimens were those of the common mouse-tail; and so it may be said that every zoologist knows, by a sort of instinct, what he means by a species. Deductions as to the changeable form of the segments of the Delphacidæ with their genital valves, perhaps may, in a limited sense, be referred to what is now known of the opercular valves of some rock-barnacles (*Pyroma*).

Both Mr. Darwin and Mr. Wallace have sought an explanation of the descent of groups of species, in the circumstance that such groups have been modified by a process of natural selection from ancestors less specialized.

It will be difficult to state any satisfactory hypothesis with reference to the arrested development of many Delphacidæ, and the cause of the persistent rudimentary characters of their elytra. Together with the rare occurrence of the fully-winged forms, almost invariably we find side by side with them forms nearly apterous. Perhaps some light may be thrown on this question by observations brought forward by Mr. Darwin on the subject of the "Disuse of parts." (See 'Origin of Species,' p. 109.) He suggests that the occurrence of so many wingless butterflies in Madeira may be due to the circumstance that security against the high winds, which would force insects out to sea, would, by an advantageous selective degradation of wing, lead them to less aërial habits. Thus a degradation from disuse would supervene, and the winged forms slowly would die out.

The question now arises, Are the voluminous wings, possessed by certain individuals of the Delphacidæ, advantageous or injurious to their economy?

As the larger number of species live and feed on the grasses and sedges which grow in swamps, and as such broad flats are peculiarly open to rough winds, we may suppose that insects having large wings, unaccompanied by strong muscles capable of vibrating the same, would often meet the accidents of draggling their wings in the pools, or getting themselves drowned outright. Thus, both males and females of such genera as *Liburnia* and *Stiroma* might be beneficially affected by a curtailment of these flying organs. Again, the occasional appearance of the Macropterous forms of both sexes would ensure the spread of the species over a larger area than could be compassed by the apterous insects. But this can be admitted only as a partial explanation, and it does not answer why other fen-species are not thus affected.

Virgil's words, "Nimium ne crede colori," adapted by Linnæus with reference to animals, may be well pondered. Considerable diversity of colouring occurs in the members of this group; but non-pigmental colour taken by itself, is not a safe guide.

Again, important as are the characters of wing-neuration, it is quite possible to come to wrong conclusions through placing too much reliance upon them. Independently of the aberrant forms, sometimes met with, the substance of the elytra is often so horny and opaque, that the veining cannot be made out with precision. Although Scott uses both colour and markings as helps to discrimination, he relies more on the position of the pro-notal keels, and their prolongation to the posterior pro-notal margin. As before stated, attention to the genital styles, and a comparison with the etched figures, given by Dr. Fieber, in 'Grunzuge zur generischen Theilung der Delphaciden,' will give material help in identifying foreign with British insects. Dissection must be resorted to in all critical species.

Until we know more of the life-histories, and can gain sure points from breeding these small Cicadæ, we must be satisfied with such small and less

obvious characters. Dr. Flor does as much as words can do towards describing the genital segments; and Kirschbaum has published a small, but not easily understood book, 'Die Cicadinen,' in reference to the same subject.

Out of the sixty-eight foreign Delphacidæ enumerated by Fieber, Edwards allows fifty to be British. Scott divides the family into five genera, which plan is adopted also by Edwards. (See 'Ent. Mon. Mag.,' May and June, 1870; and also 'Trans. Ent. Soc.,' June, 1886, p. 55.)

DELPHACIDÆ.

Basal antennal joint much longer than the second.		Basal antennal joint much shorter than the second.		
Middle facial keels.		Middle facial keels.		
One.	Two.	One only.		Two.
		Keel forked on the vertex, or else entire.	Keel forked before the vertex.	
Delphax.	*Asiraca.*	*Liburnia.*	*Dicranotropis.*	*Stiroma.*

Genus VIII.—ASIRACA, *Latr.*

Plate VIII., figs. 1 to 7.

Delphax clavicornis, Fab. Spin.
Asiraca clavicornis, Curt., Marsh., Kirschb., Scott, Fieb., C. E., pt. iii., 1; Edw. pt. i. 56,

Frons with two middle keels. Antennal first joint foliaceous, trigonate, prismatic, and nearly three times longer than the second. Second joint somewhat cordate, bristly, and ending with a seta. Pronotum with three distinct keels. Scutellum with four longitudinal keels. Elytra without basal cells. Fore femora and tibiæ dilated or flattened, posterior tibiæ with three spines on the outer edge. Head and part of the pronotum pale; the rest of the pronotum and scutellum black, with faint keels and scale-like hairs. Elytra grey, with traces of a white band at the base. Veins yellowish,

raised, and sparsely furnished with setigerous granules. Abdomen black above. Front legs black, with pale yellow spots. Apex of tibiæ whitish. Hind tibiæ dark ochreous. The tibial laminated spur is small, but smaller crescentic spurs occur at the bases of the tarsal joints.

The form of this remarkable insect recalls that of *Nepa*, the water-scorpion. Its limbs are flattened, like those of the mole-cricket (*Gryllotalpa*), and are well fitted for burrowing under the roots of grasses in dry places, where it locates itself. It is the sole representative of the genus in this country, and is rarely taken; or at least it has been very seldom recorded. My figures are drawn from insects formerly in Mr. Dale's collection.

Expanse, 7·00 millimètres, or 0·27 inch. Size of body and elytra, 4·00 millimètres, or 0·16 inch.

Genus IX.—DELPHAX, *Fab.*

Face with one middle keel, hardly visible on the vertex. Antennæ with first joint trigonate and foliaceous. Legs with fore femora and tibiæ not dilated.

Delphax pulchella, Curt., Scott., Edw. pt. i. 56.
,, *dubia*, Curt. pl. 445.
Araeopus crassicornis, Marsh., Kirsch.
,, *pulchellus*, Fieb., C. E., pt. iii., 6, 2.
,, *Minki*, Fieb., G. D. 522.
Delphax Minki, Sahlb.

Pronotum dentate at the sides of the female, with three indistinct keels. Elytra without setigerous granules. A broad variable band, generally crescentic, marks the base, and another extends half-way towards the apex. Ocelli distinct, and sunk in pits on the vertex. Two strong spines on the outer edge of the hind tibiæ. A large spur at the base. Abdomen black, the two first rings covered by a large irregular scale (post-scutellum). Anal process of the male long, with the angular styles free, and projecting beyond the last

abdominal segment. Male genital valve below, large, and semi-cylindrical.

The brachypterous female is much larger than the fully-winged male. Taken on swampy land in July. It is not uncommon on the marshes at Lee, Middlesex.

Size, 5·00 to 6·0 millimètres, or 0·19 to 0·23 inches.

Genus X.—LIBURNIA, *Stal.*

Face with one middle keel, not distinctly furcate on the forehead. Antennæ not foliaceous. First and second joints rather cylindrical; first shorter than the second. Pronotum and scutellum with side keels diverging, yet reaching to the posterior margin of pronotum. Scutellum with three keels. Elytra and wings usually only partially developed. The males usually are fully winged. Hind tibiæ with an upper and lower tooth on the outer edge. A large laminated spur is attached to the extremity of the hind tibiæ.

Mr. J. Edwards describes fifty British species. They are generally small, and some are difficult to separate. Attention must therefore be given to minute characters.

Liburnia notula, *Germ.* Plate IX., figs. 1 to 4.

Delphax notula, Germ., Flor., Marsh.
,, *truncatipennis*, Kirschb., Boh.
,, *lineola*, Stål.
Megamellus notulus, Fieb., G. D. 519, t. 8, fig. 2, Sahl.
Liburnia notula, Scott. Edw. pt. i. 61.

Side keels of the pronotum reaching to its hind margin. Basal joint of the antennæ two-thirds of the second joint. Basal joint of the hind tarsi longer than the two others taken together. Scutellum as long or longer than the pronotum. Elytra of the macropterous female one-third longer than the abdomen; colour greyish green; veins black. Elytra of the brachypterous female only one-third the length of the abdomen. Frons brown or yellowish. In the dark specimens the keels

are ochreous, and thus are carried through the clypeus. Abdomen yellow, barred with brown or black. Pygofer truncated, with the anal style projecting. Not uncommon on marshy lands.

Size, 3·0 to 4·0 millimètres, or 0·12 to 0·16 inch.

LIBURNIA LINEOLA, *Germ.* Plate IX., figs. 5 to 6.

Delphax lineola, Germ., Marsh.
,, *longifrons*, Boh., Kirsch.
Stenocranus lineolus, Fieb., G. D. 519, t. 8, fig. 3; C. E. pt. iii. 11.
Stenocarenus minutus, Sahlb.
Liburnia lineola, Scott, Edw. pt. i. 62.

Form rather linear. Vertex prolonged beyond the eyes. Elytra yellowish, with a greenish tinge. Nerves pale; a dark band occurs, broadest at the apex of the elytra, and tapering towards the base, which it does not reach. Pronotum reddish brown, with three yellow streaks or keels. Scutellum sinuously pointed. Abdomen yellow, with brick-red markings, and black segmental streaks. Wings hyaline and iridescent. Front legs long and yellowish. Hind legs grey, with black lines on the thighs.

Size, from 4·0 to 5·0 millimètres, or 0.16 to 0·20 inches.

N.B. — Some varieties occur entirely without the above dark band on the elytra. Not uncommon on long grasses in Germany, France, and Sweden.

LIBURNIA FUSCOVITTATA, Stål. Plate IX., figs. 7 to 10.

Delphax fuscovittata, Stål.
,, *major* and *D. colorata*, Kirschb.
Stenocranus fuscovenosus, Fieb. (see styles), G. D. t. 8, fig. 3.
Stenocranus fuscovittatus, Fieb., C. E. pt. iii. 12.
Liburnia fuscovittata, Scott, Edw. pt. i. 62.

Linear, pale dirty fuscous yellow above. Vertex projecting, with two strong keels carried to a point

beyond the eyes. Elytra long, with a brown apical streak. Border of the pronotum sinuous. Legs pale. Abdomen dark brown, with light edges. Front tibiæ with narrow brown streak.

Rare. Size, from 4·0 to 5·0 millimètres, or 0·15 to 0·19 inches.

My figures are drawn from Mr. Douglas' collection.

Liburnia vittipennis, Sahlb., Plate X., figs. 1, 3, and 9.

Delphax vittipennis, Sahlb.
,, *guttiferus*, Kirschb.
Stenocarenus guttuliferus, Sahlb.
Liburnia guttula, Doug.
Kelisia vittipennis, Fieb., C. E. pt. iii., 23.
Liburnia vittipennis, Edw. pt. i. 63.

Head and pronotum yellowish white. Eyes grey. Upper part of pronotum marked with variable vertical streaks; lower half with two broad black triangular patches, more or less obscuring the same. Abdomen fusiform, with the somites or rings edged with black. Pygofer black, with a remarkable dilated anal-process, which protrudes beyond the last segment. Elytra iridescent, with a dark apical blotch, and a brown costa. Styles laminar and twisted (see fig. 9, Pl. IX.).

The brachypterous insect is less common than the fully-winged form. It is rather like *L. guttula*, but it may be distinguished from it by its superior size.

Size, from 3·0 to 4·0 millimètres, or 0·12 to 0·16 inches.

Liburnia longipennis, Curt. Plate X., figs. 4, 5.

Delphax longipennis, Curt., see pl. 657, Brit. Ent.
Stenocranus longipennis, Fieb., C. E. pt. iii., 13.
Liburnia longipennis, Scott, Edw., pt. i. 63.

Vertex pointed, and projecting beyond the eyes. Frons long, with the clypeus dividing it in half,

PLATE A.

Fig. 1.—Body of *Tettigonia viridis*, seen from the upper side. *a*. Vertex or crown, at the base of which the ocelli are seen. *f*. Upper part of the frons or face, which passes over to the under side of the head. *g*. Oculi, or compound eyes. *b*. Neck, connecting the head with the pronotum. *c*. Bosses on the pronotum, under which the muscles are placed to work the wings. *d*. The scutellum, below which may often be traced the metathorax. *1* to *8*. Represent the somites, or body-rings of the abdomen; the last ring carries the pygofer. *e*. Part of the costa of the elytron. *t*. The insertion of the wing. In some species the insertions of the elytra are covered by small scales or tegulæ.

Fig. 2.—The same insect, seen from below. *f*. The frons, which is often striated with colour. *a*. The antennæ. *l*. The gulæ, or cheeks; and below these the clypeus, *c*, ending with the rostrum, *r*, containing setæ. The fore legs, as in other insects, rise from coxæ articulated to the sternum; the middle legs rise from the meta-sternum, and the hind legs from the post-sternum. *x*. Coxæ. *m*. Femur. *t*. Tibia. *n*. Tarsus. The rings of the abdomen are thrown into folds, on the under parts of which the stomata are placed. The middle plates are much broader. In *Tettigonia*, five distinct rings are to be counted, succeeded by the navicular plates (*b*), and the two large valves, which in the female enclose the complicated saws and appendages. In the males, the pygofer encloses the genitalia.

Fig. 3.—Head of one of the Jassidæ, viewed partly from the front. *f*. Frons. *g*. The eyes. *i*. Ocellus. *a*. Antenna. *c*. Clypeus. *r*. Rostrum, with its basal joint.

Fig. 4.—The ocellus, highly magnified, showing its lens-like form.

Fig. 5.—Part of the underside of *Tettigonia*. *f*. Commencement of the frons. *c*. Clypeus. *k*, *l*. Parts of

the prosternum. *e.* Elytron. *w.* Wing-attachments. *n.* Meta-sternum. *x*, *x*, *x*. Coxæ.

Fig. 6.—Abdomen of a female *Jassus*. *e.* Saw case. *d.* Valves of the pygofer. *a.* Basal plate. *f.* Navicular plate.

Fig. 7.—Head of a Delphacid. *f.* Lower part of the frons. *c.* Clypeus ending in a lanceolate labrum, which partly overlaps the second joint of the rostral sheath. The three lancets often protrude from the thickened end of the last joint.

Fig. 8.—End of the hind tibial and tarsal joints of *Liburnia pellucida*, showing (at *c*) the remarkable serrated and laminated spur, which is common to the Delphacidæ. Probably this is used not only as a help in leaping, but also it assists the insect in preening itself, an occupation in which the Cicadæ seem to take much delight. The tarsus is very rough, with spurs (*a* and *b*) and prehensile plates.

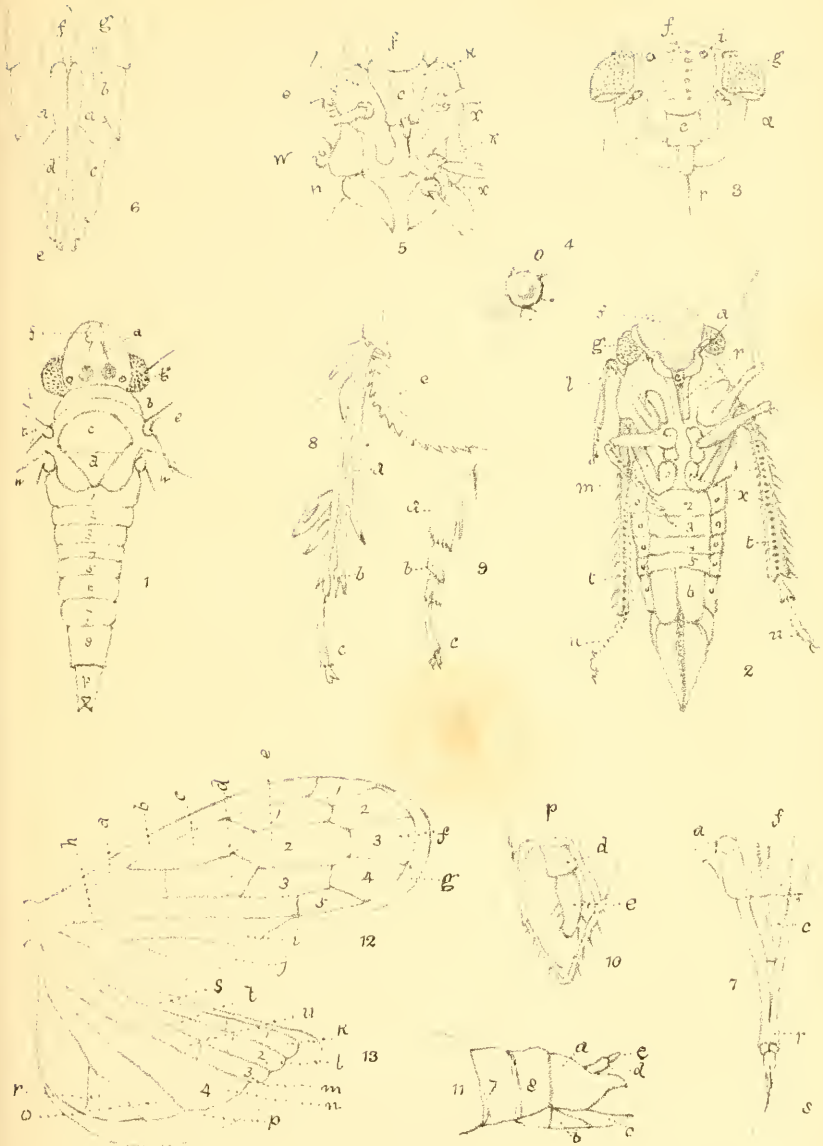
Fig. 9.—Shows the same relative parts on the fore leg.

Fig. 10.—Part of the pygofer, with its anal tube or colesteron (*d*), and the anal style or cauda (at *e*).

Fig. 11.—The last abdominal ring of one of the Typhlocybidæ. *a.* Pygofer. *c.* Genital plate, or port-penis(?), of Fieber. *e.* Anal process and appendages.

Fig. 12.—Elytron of *Macropsis*, showing the wing-cells. *a.* Basal cell. *b.* Costal cell. *c.* Discoidal. *d.* Supra-marginal. *e*, *1*, *2*, *3*. Subapical cells. *f*, *1*, *2*, *3*, *4*, *5*. Apicals. *g.* Limbus, or appendix. All these cells are comprised in the corium. This part of the elytron is divided from the clavus by a straight suture. The clavus, or lower part of elytron, is formed of cells more or less closed, and bounded by the anal and axillary nervures.

Fig. 13.—The wing is sometimes subject to considerable variation, but not so much as to prevent the characters being used for the distinction of genera. In the figure, *k*, *l*, *m*, *n*, may be named as the first, second, third, and fourth apical cells; *r* and *o*, the anal and axillary wing-cells; *p*, the marginal membrane, which usually fringes the wing-cells.



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West, Newman imp

PLATE B.

Fig. 1.—Sternum of *Cicada orni*(?), with portions removed, so as to uncover parts of the sounding organs. *m*. Muscle, which works the tympanum (*c*). *x*. Abdominal cavity, filled with air. *y*. Viscera and dorsal muscles (*f*, *f*). After Prof. Lipori.

Fig. 2.—*a*. Metathorax, with part of the coxæ. *b'*. Right opercular plate detached, and exposing to view the inner parts. *b*. Left opercular plate. *c*. Inner shining annular membrane, or tympanum. *d*. External portion of the sounding cavity. *e*. Septum, which divides the internal segment. *f*. Pellucid or mirror-like membrane. *g*. Outer fascia of the sternum, which forms the internal wall of the cavity. *h*. Sternite. After Prof. Lipori.

Fig. 3.—Corrugated membrane of the tympanum stretched by its muscle. *m*. The muscle itself. *t f*. The funicular portion of the tendon.

Fig. 4.—Diagrammatic section of the thorax of a Cicada, seen from the anterior end. *d*, *d*. Corrugated membranes, to the centres of which are attached fine ligaments, through which the parchment-like membranes are made to vibrate. *m*, *m*. The two fasciculi of muscle, which vibrate the same. *v*. Vertical membranous septum. *p*. Dorsal cover-plate of the right side; that of the left has been removed. *s*, *s*. Sterna of the first and second somites, with posterior membranes stretched between them. After Mr. C. L. Morgan.

Fig. 5.—Part of the apparatus of the female of *Athysanus communis*, with its double saws (*s*, *s*). These consist of two long, thin, chitinous blades, set with teeth on one side. *r*, *r*. Portions of the rasp-like laminæ.

Fig. 6.—Portion of the saw-like apparatus of *Tettigonia viridis*. *s, s*. The saws, which are strongly backed and set with square teeth. The side plates (*f, f*) are grooved on the flat, and seem in some way to act as rasps, as well as sheaths. The centres of motion, with horny attachments, are seen below, and through these an alternating motion is effected on the saws. *l, l*. Opposing ligaments.

Fig. 7.—Eight ova, the contents of the body of an *Athysanus*. They occupied almost the whole cavity of the abdomen.

Fig. 8.—The stomach of *Aphrophora*, showing a long tortuous vessel within, and attached to its walls. This long tube exhibits a marked rhythmical action, long after its separation from the body. It ends in a convoluted tube, which passes to the rectum, and through the anus it pours out the spume in which the insect hides itself; or possibly it also conducts air, secreted from the juices of the body to the same place, to blow the bubbles, so well known, as cuckoo-spits. When this viscus is plunged into weak alcohol, numerous bubbles are disengaged, as if air was held in solution in some fluid contained within the viscus.

Fig. 9.—Another dissection, from a similar insect. Here the tortuous vessel appears disjointed, and shows, what seems to be, open mouths (*p, p*). At *w* and at *t*, the pyloral sac is seen studded with nucleated epithelial scales (*n*). The sac is charged with alimentary matter. The small duct (*o*) could not be traced beyond the viscus, and it might be exterior to it. Both these drawings were made direct from the camera-lucida.

Fig. 10.—Elytron, showing:—*a*. Costal nervure. *b*. Cubital. *c*. Subcubital. *d*. Supra-marginal. *e*. Anti-apical. *f*. Anal. *g*. Axillary. *h*. Marginal. *l*. Limbal. *p, p, p*. Apical. *s*. Suture. *t, t, t*. Transverse nervures.

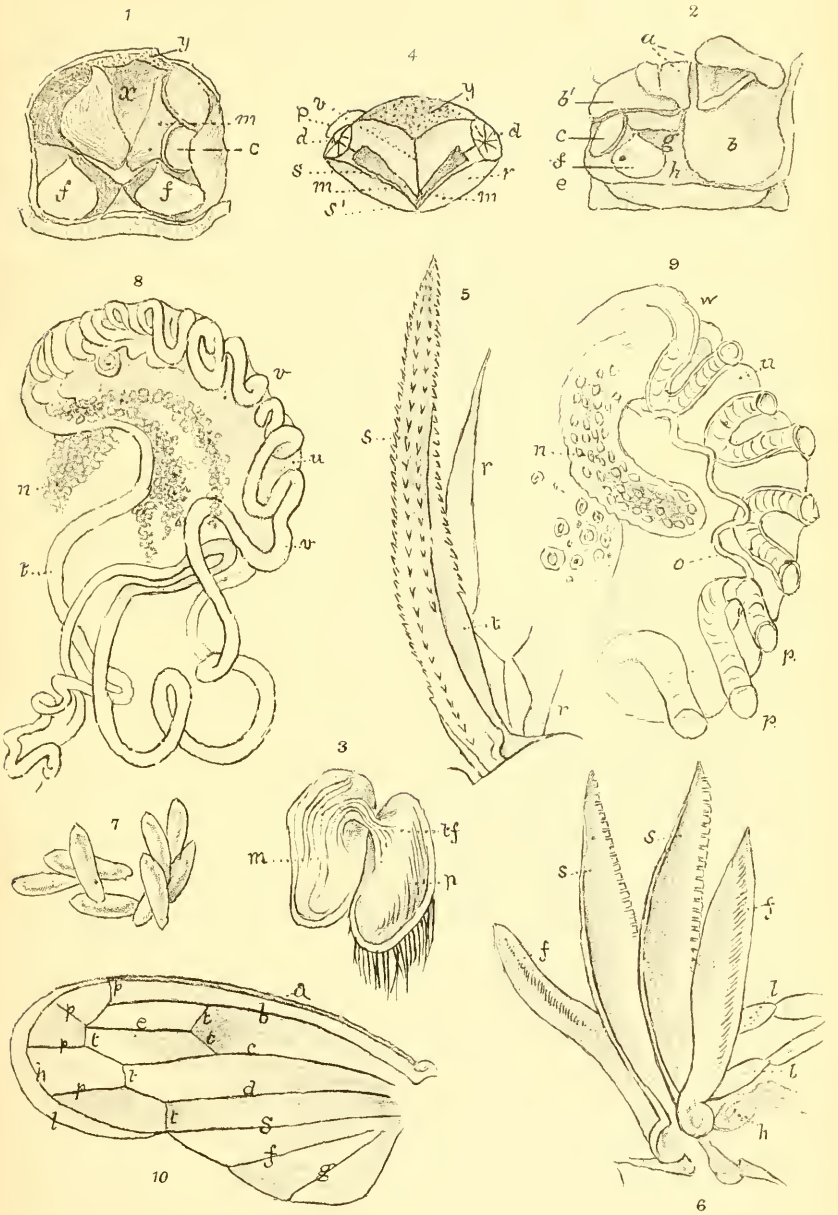

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PLATE I.

Athenian Coins. (Page xi.)

Figs. 1 and 2.—Obverse and reverse of a silver tetradrachm, having the representation of a Tettix or Cicada for a symbol of the chief magistrate, whose name is inscribed.

Figs 3 and 4.—The two sides of a copper coin, having thereon, respectively, figures of the Owl, sacred to Pallas, and the Tettix.

Figs. 5 and 6.—A similar coin, stamped with the head of Pallas, and also a Tettix on the reverse.

These drawings are taken from specimens to be seen in the British Museum.

Cicadetta montana. (Page 1.)

Fig. 7.—Slightly enlarged representation of the imago, or winged insect. The exact size, *viz.*, expanse of wings and length of body, is given by the lines at the foot of the Plate.

Fig. 8.—Larval form. After Westwood.

Fig. 9.—Pupal stage. Its active habits are shown by the presence of legs, &c. After Mr. E. Newman's figure.

Fig. 10.—Ventral view of the abdominal rings, with their separate stomata (*e*, *e*). The apex of the abdomen is occupied by the pygofer, which, in the female, consists of the navicular valve (*v*), the double sheath enclosing the complicated saws (*d*), the outer plates (*c*), and the basal plates (*g*). At the base of the meta-sternum the broad plate or operculum (*b*) is seen.

This is small in the female, but well developed in the male insect.

Fig. 11.—Coxa, toothed femur, tibia, and tarsus of fore leg of *Cicadetta montana*.

Fig. 12.—Head and proboscis seen from below. *v*. Vertex, with its three ocelli (*o*). *e*. Compound eyes. *f*. Frons, with its striated markings. *c*. Clypeus. *l*. Labrum. *p*. Proboscis, with its lancets. The antennæ are seen inserted between the eyes and the frons, or face.

Fig. 13.—Antenna, with its basal and second joints, and its obscurely-seen seven(?) joints, comprising the seta.

Fig. 14.—Upper portion of the body of *Cicadetta*. *r*. Vertex, and three ocelli. *p*. Pronotum, with its lobes. *t*. Mesonotum, with the scutellum (*s*). *u*. Metanotum. After Fieber.

Fig. 15.—Coxal spur on the inner sinus of the operculum. It may also be seen in certain Fulgoridæ.

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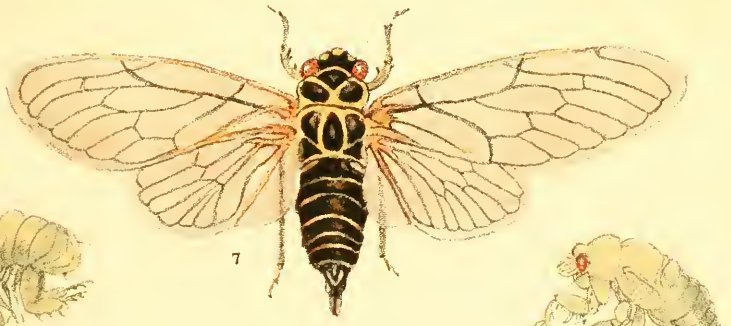

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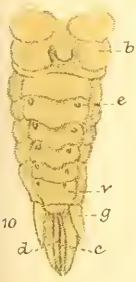

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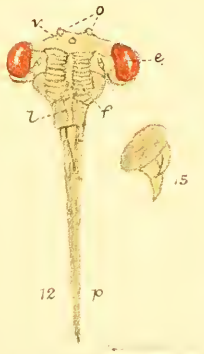

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West, Newman chrom.

PLATE II.

Centrotus cornutus. (Page 6.)

Fig. 1.—Dorsal aspect, showing (*a*) the horn of the pronotum projecting beyond the tail, and the lateral horns of the pronotum.

Fig. 2.—Side view of the same insect, showing the prolongation (*b*) of the scutellum, and the horn (*a*) of the pronotum.

Fig. 3.—Front view, showing the pronotum (*p*), the frons (*f*), the clypeus (*c*), the rostrum (*d*), and the fore leg (*g*).

Fig. 4.—A fore leg, with two tarsal joints.

Fig. 5.—A hind leg, with three tarsal joints.

Fig. 6.—The end of the tarsus, with its blunt claws.

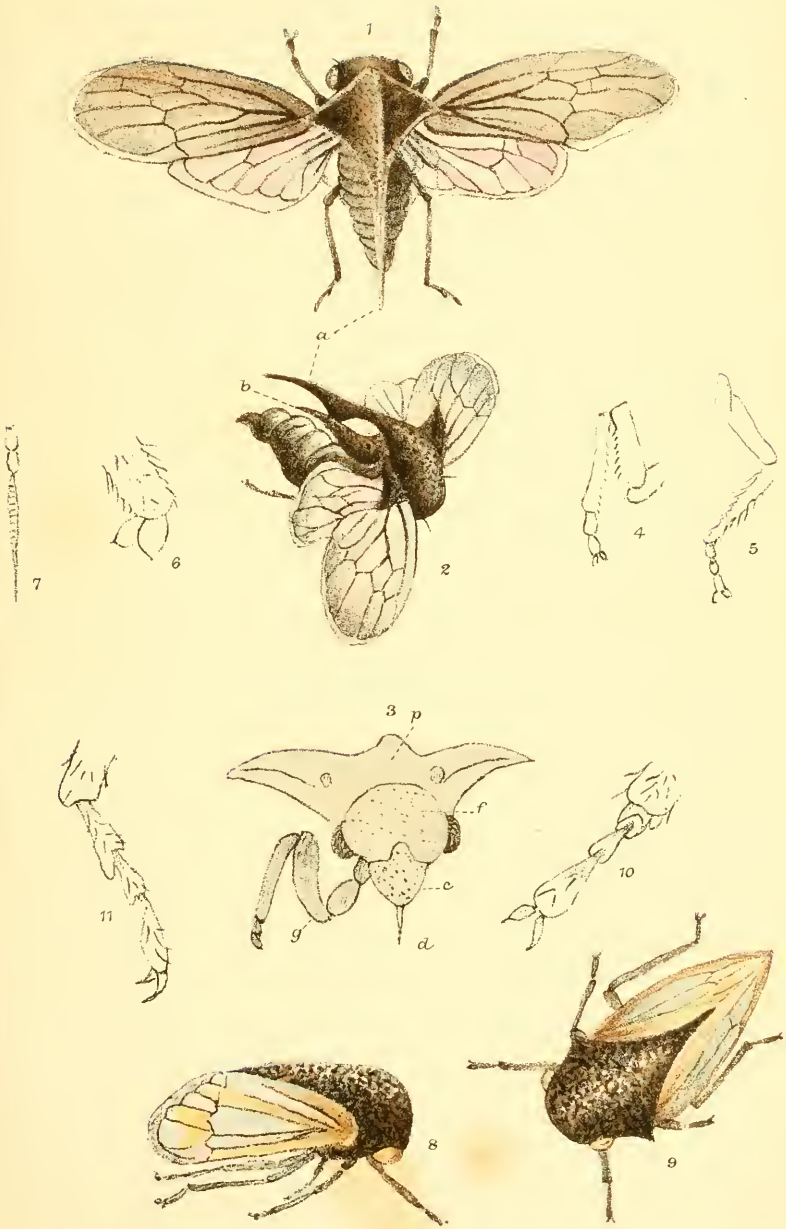
Fig. 7.—The antenna, with its seta tapering to a mere bristle.

Centrotus genistæ. (Page 7.)

Fig. 8.—Profile view of the insect, showing the shorter prolongation of the pronotum, and the sub-horizontal position of the head and eyes.

Fig. 9.—Dorsal view of the same, showing the form of the pronotum.

Figs. 10 and 11.—Enlarged side, and under-views of the tarsus of the hind leg.



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West, Newman chromo.

PLATE III.

Issus coleoptratus. (Page 11.)

Fig. 1.—Winged male. It is smaller than the female.

Fig. 2.—Elytron. *a.* Corium. *c.* Clavus. *d.* Suture.

Fig. 3.—Wing of the same.

Fig. 4.—Head of the same. *e.* Compound eye. *g.* Basal antennal joint. *f.* Swollen second joint, with seta rising from the upper side.

Fig. 5.—Pygofer of the male: ventral or lower aspect.

Fig. 6.—The same, from the dorsal or upper aspect. *e.* Anal opening, with its style. *h.* Lateral lobe.

Fig. 7.—Tarsus of hind foot.

Fig. 8.—Larval form of the same insect; the pronotum is studded with tubercles.

Fig. 9.—Frontal view of the head and eyes. *f.* Frons, or face.

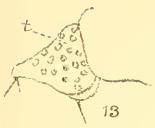
Tettigometra impressopunctata. (Page 10.)

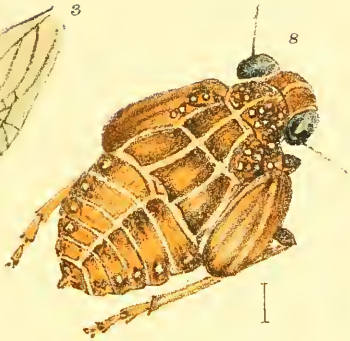
Fig. 10.—Upper view of the winged insect. *t.* Tegula.

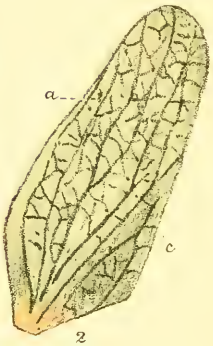
Fig. 11.—Under side of the male. *r.* Rostrum folded between the legs, and flagelliform penis.

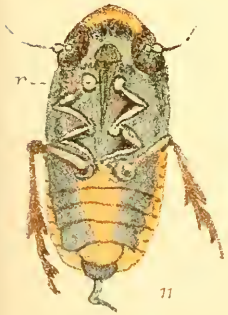
Fig. 12.—Elytron and wing.

Fig. 13.—Posterior edge of pronotum. *t.* Tegula.









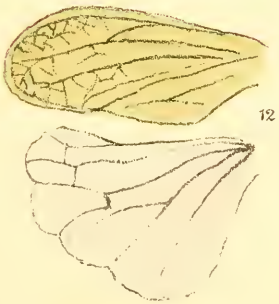


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PLATE IV.

Oliarus pallidus. (Page 16.)

Fig. 1.—Imago. *a*. Natural size.

Oliarus leporinus. (Page 17.)

Fig. 2.—Imago, with five indistinct keels on the pronotum.

Fig. 3.—Head, frons, clypeus, and antennæ of the same.

Fig. 4.—Elytron.

Cixius nervosus. (Page 18.)

Fig. 5.—Winged form, with the pygofer tufted with filamentous matter, and surmounted by the anal style.

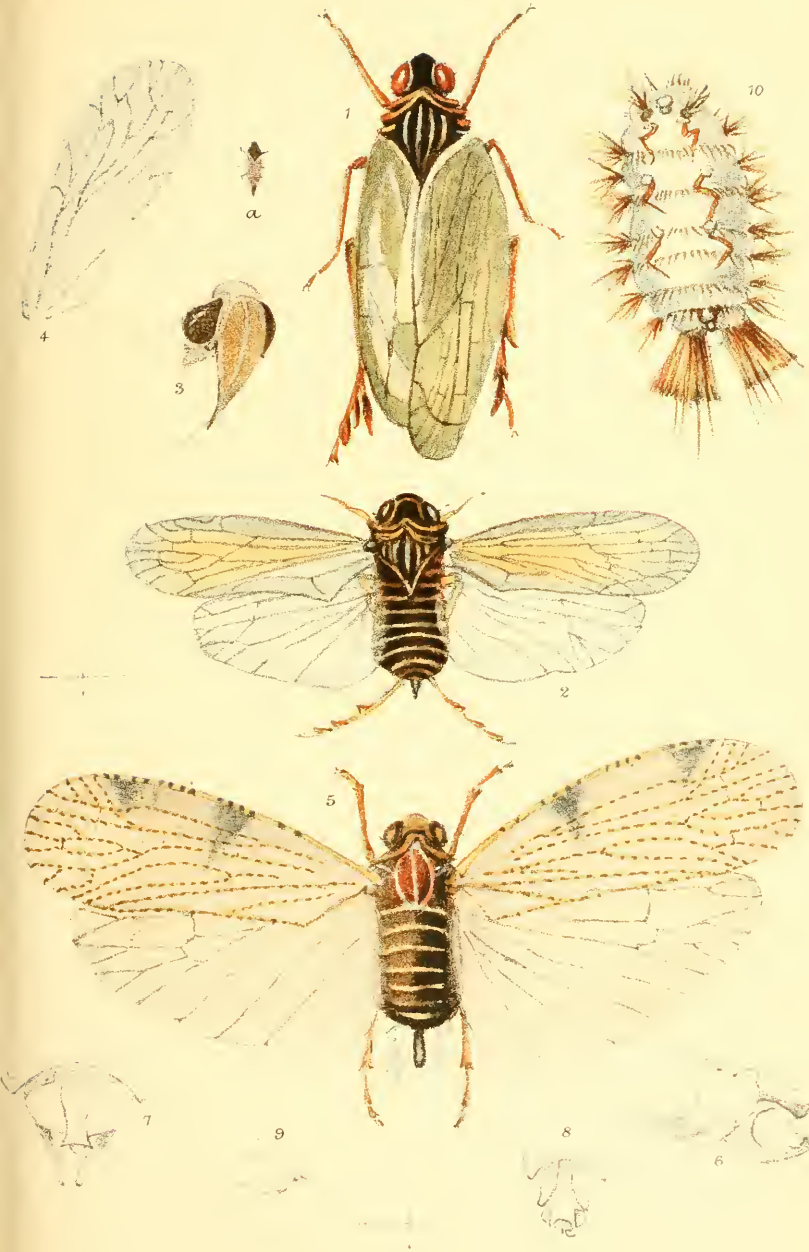
Fig. 6.—The same, seen sideways.

Figs. 7 and 8.—Anal appendages, divested of the tufts.

Fig. 9.—Antenna, with bulbous root of the seta.

Fig. 10.—Larva of an *Anthrenus* (coleopterous).

N.B.—This insect is not parasitic on the *living* Cicada. It is destructive to stored specimens.



G B B. del et lith

West, Newman chrom.

PLATE V.

Cixius stigmaticus. (Page 19.)

Fig. 1.—Winged female, showing the anal style and point of the saw-case. The rest is hidden under the flocculent silky matter of the pygofer.

Fig. 2.—Side view of a darkly coloured specimen in Mr. Douglas' collection, almost divested of the dark barring on the elytra.

Fig. 3.—Part of the genitalia of the male, showing the embracing sheath of the penis, and its styles(?). *p*. Penis. *s*, *s*. Style. *q*. Prepuce. *h*, *h*. Outer leaves of the sheath.

Figs. 4 and 5.—Fore and hind tibiæ of the same.

Fig. 6.—Terminal joint of the tarsus, with its double claw, two bristles, and pulvillus (*b*). Insertion (*i*).

Cixius brachycranus. (Page 20.)

Fig. 7.—Moth-like position taken by the insect, with its wings in repose.

Fig. 8.—Ventral aspect of the head and clypeus.

Fig. 9.—Dorsal view of the male genitalia. *p*. Penis. Part of its sheath (*s*).

Fig. 10.—Spurred tibia and tarsus of the hind leg.

G.B.B. del. et lith.

West Newman chromo

PLATE VI.

Cixius pilosus. (Page 21.)

Fig. 1.—Imago, showing the transverse dorsal band of flocculent matter, and also the flocculent mass at the caudal end.

Fig. 2.—Frons, clypeus, antennæ, and rostrum. The faces of these insects whilst walking are always turned towards the ground (sub-horizontal).

Fig. 3.—Head, pronotum with its three keels, and (*a*) tegula at the insertion of the elytron.

Fig. 4.—Side view of the anal style, and the lower sheath, divested of its silken matter, and made transparent by potash solution.

Fig. 5.—The same, showing the filamentous matter attached.

Fig. 6.—The three-jointed tarsus and blunt claws.

Cixius cunicularius. (Page 19.)

Fig. 7.—Imago, with its closed wings.

Fig. 8.—Pygofer of the female, lateral aspect.

Fig. 9.—Front view of the frons, with its keels.

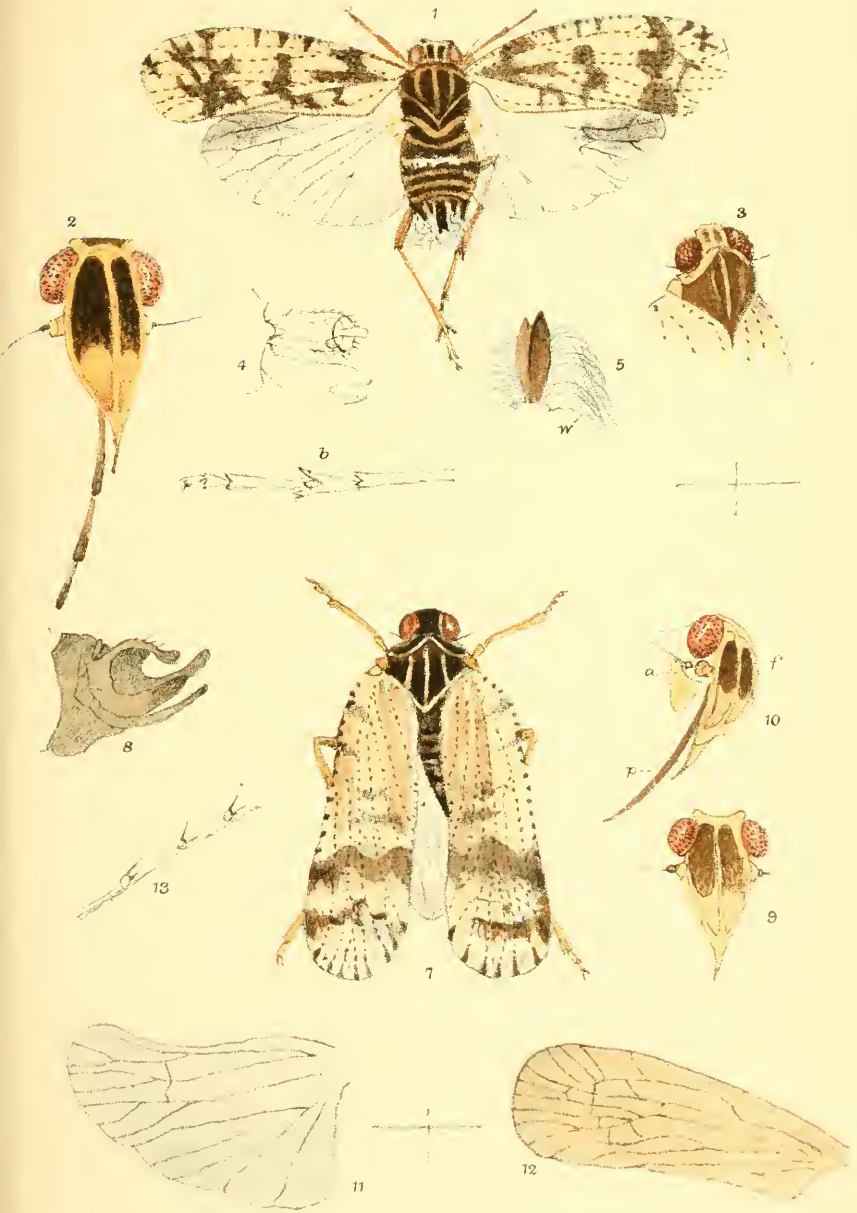
Fig. 10.—Side view of the same, showing the position of the first joints of the antenna (*a*). *p*. The rostrum. *f*. The frons.

Fig. 11.—The wing, with its venation.

Fig. 12.—The elytron, with its venation.

Fig. 13.—Part of an elytral vein, furnished with the bulbous hairs, which form the visible dots or punctuation.

This insect was figured from one in Mr. Edwards' collection.



G B E del et lith

West Newman chromo.

PLATE VII.

CIXIUS PILOSUS, var. ALBICINCTUS. (Page 19.)

Fig. 1.—Winged form.
Fig. 2.—Frons, with rostrum, of the same insect.
Fig. 3.—Profile view of the naked pygofer.
Fig. 4.—Head, vertex (*v*), pronotum, and tegula (*t*).
Fig. 5.—Dorsal aspect, showing the basal lobes and the two sheaths containing the saws, forming part of the pygofer. The anal tube is drawn above.

CIXIUS SIMILIS. (Page 22.)

Fig. 6.—Imago; called *C. remotus* by Mr. Edwards.
Fig. 7.—The elytron.
Fig. 8.—The wing.
Fig. 9.—The under view of the frons, &c.

CIXIUS SIMPLEX. (Page 22).

Fig. 10.—The imago, with its transparent folded wings, called *C. Scotti* by Edwards, by whom the specimen figured was kindly lent.

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PLATE VIII.

Asiraca clavicornis. (Page 28).

Fig. 1.—Imago, showing its peculiar anterior limbs, fitted for burrowing, like those of the mole-cricket.

Fig. 2.—Dorsal view of the head, showing the position of the eyes and the insertion of the antennæ. The prismatic form of the basal joint, and the tubercular character of the second joint is to be remarked; also the mode of the carination on the vertex (*v*).

Fig. 3.—The elytron and the wing.

Fig. 4.—The serrated character of the tarsus is marked; and here is seen the first indication of the spurred wing-like scale at the extremity of the tibia, a characteristic of all the Delphacidæ.

Fig. 5.—Enlarged view of the fore leg.

Fig. 6.—Caudal end, with its basal plates, its anal tube, and short anal style.

Fig. 7.—Portion of a nervure of the elytron, with its row of bulbous hairs.

Delphax pulchella. (Page 29.)

Fig. 8.—Macropterous form of the male insect.

Fig. 9.—Brachypterous form, the elytron barely reaches half the length of the abdomen.

Fig. 10.—Front view of the head, showing the points of insertion of the antennæ, the frons (*f*), and the fore legs (*l*, *l*).

Fig. 11.—Pygofer of the male seen from behind, showing the anal style or cauda (*a*), the curiously shaped prehensive styles (*s*, *s*), and the sheath of the penis between these.

Fig. 12.—Ventral aspect of the pygofer of the female. *a*. The anal tube, with its style. *h*. The sheath containing the saws. *b*. The basal plate. *t*. The lateral valve.

Figs. 13 and 14.—The elytron and wing of *Delphax pulchella*. The neuration of both organs is more simple than that of either the preceding or the following genus.

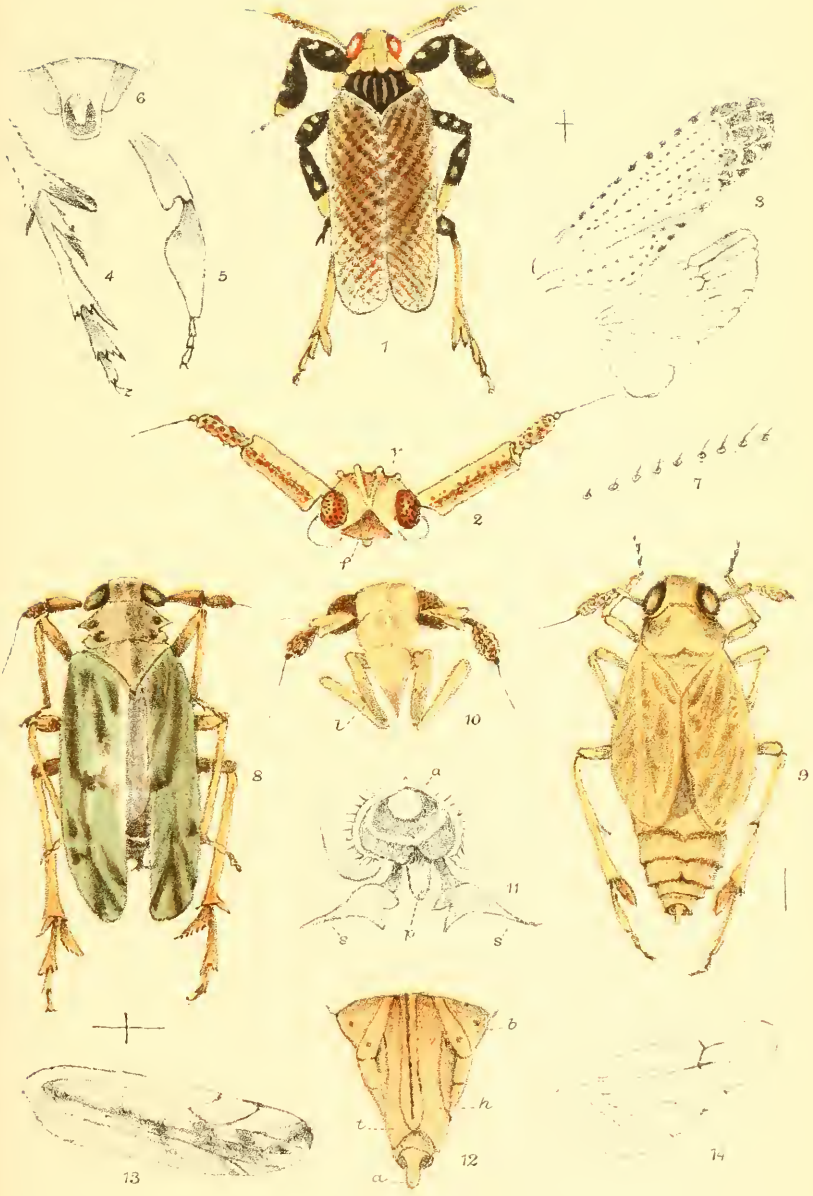
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PLATE IX.

Liburnia notula. (Page 30.)

Fig. 1.—The macropterous male, with its projecting vertex and marked carinæ.

Fig. 2.—The brachypterous female, showing the long second antennal joint.

Fig. 3.—The frons, clypeus, eyes, and antennæ of the same.

Fig. 4.—Pygofer of the female, showing the basal plates and valvular sheath of the serrated ovipositor.

Liburnia lineola. (Page 31.)

Fig. 5.—The macropterous imago, showing details of the pronotum, scutellum, and abdomen.

Fig. 6.—The female, with closed elytra.

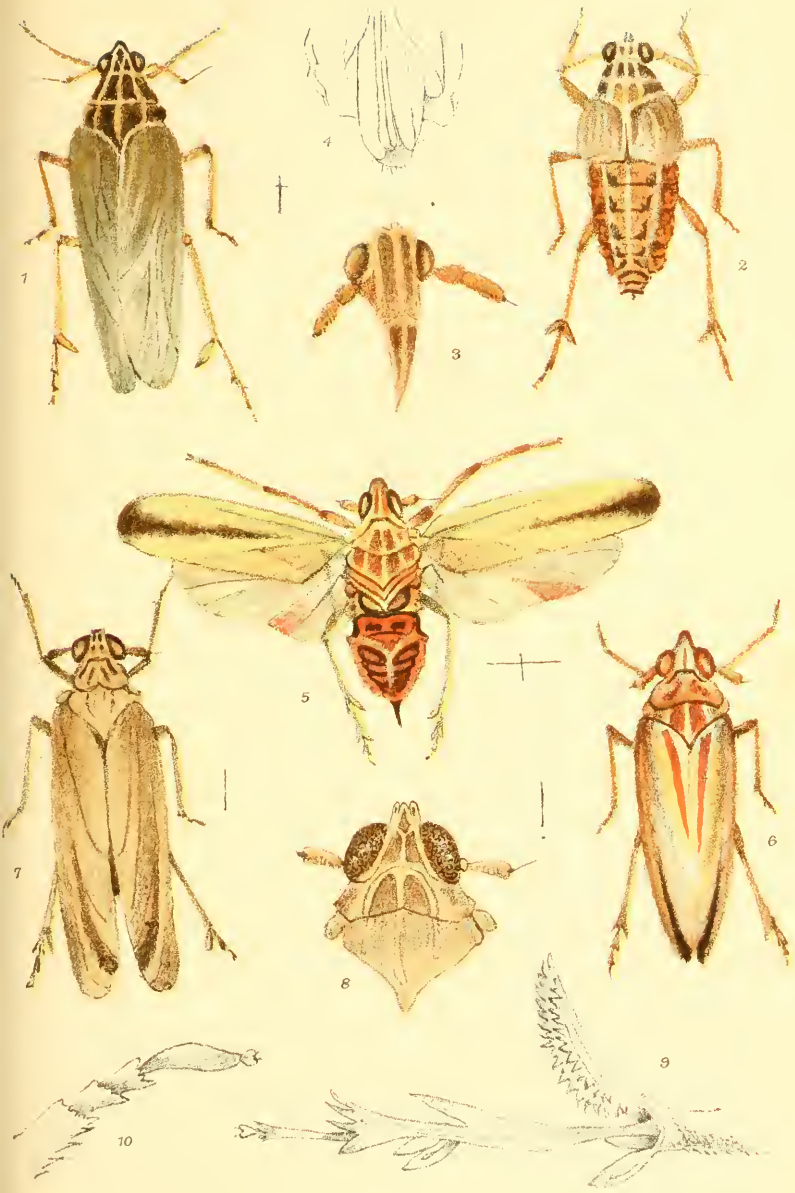
Liburnia fuscovittata. (Page 31.)

Fig. 7.—The macropterous form.

Fig. 8.—The head and thorax of the same, showing the keels of the vertex, the antennæ, which are inserted at the under margin of the eyes, and the small tegulæ.

Fig. 9.—Magnified view of the serrated tibial spur, and the laminated spines of the tarsus of the hind leg.

Fig. 10.—Tarsus of three joints, and terminating claw of the fore leg of the same insect.



G B B del et lith.

West Newman chromo

PLATE X.

Liburnia vittipennis. (Page 32.)

Fig. 1.—Macropterous male, showing the venation of the elytra and wings.

Fig. 2.—Macropterous female, which is larger.

Fig. 3.—Part of the male pygofer, with its peculiar anal process (pygothèque?) and its style. This last is not to be confounded with the ordinary male styles, which are not here shown, but are inserted below the anal process.

Fig. 4.—Pygofer, with the saw enclosed in valves.

Liburnia longipennis. (Page 32.)

Fig. 4.—Macropterous male. The wing-neuration may be studied as typical.

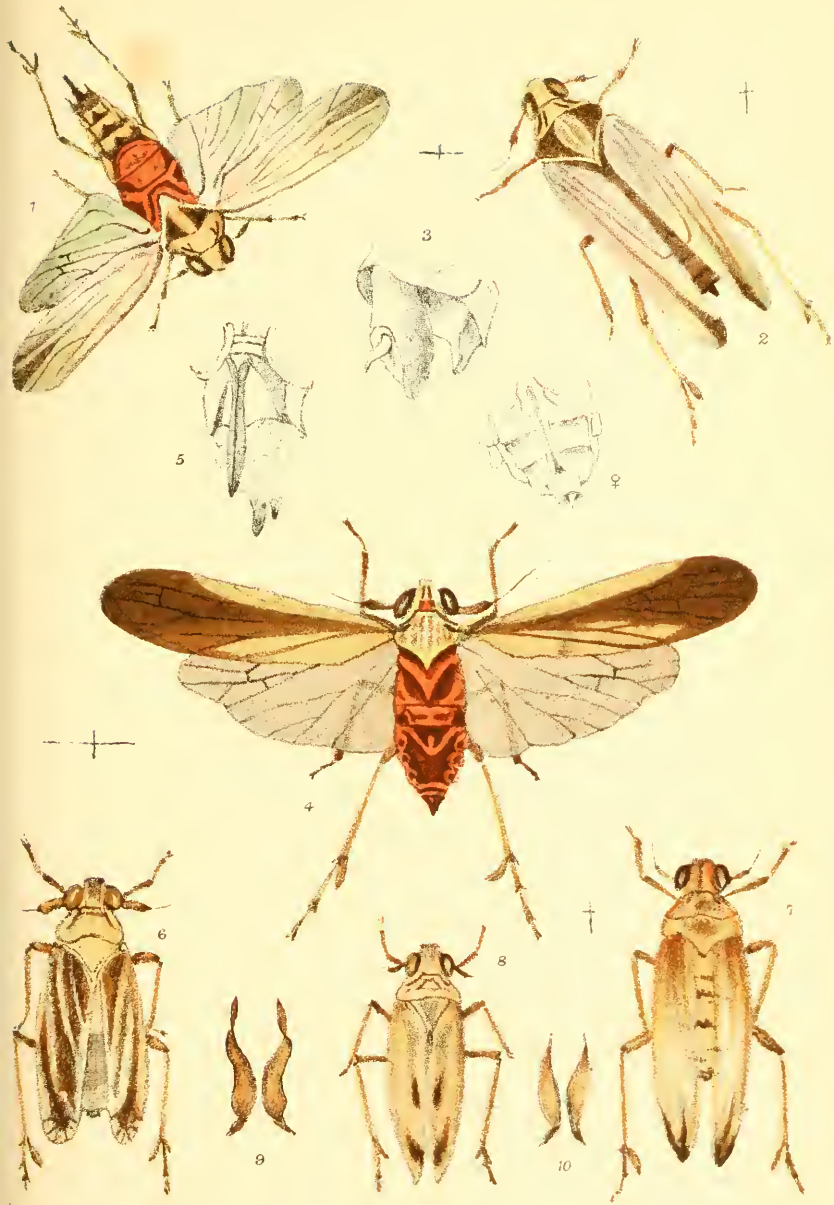
Fig. 5.—Part of the pygofer of the female, with the saw-case and anal process embedded in cottony fibre.

Liburnia Scotti. (Page 33.)

Fig. 6.—Macropterous female; fig. 7, a pale variety; and fig. 8, the winged male: all in relative sizes.

Fig. 9.—The twisted styles of the male of *L. vittipennis*.

Fig. 10.—The styles of the male of *L. guttula*.



G B B del et lith.

West, Newman chrom

MONOGRAPH

OF THE

BRITISH CICADÆ

(Froghoppers and Grassflies).

By GEORGE BOWDLER BUCKTON, F.R.S., &c.

The comparison of specimen with specimen is the basis of all zoological and biological research. Doubtless, after living forms, collation with museum specimens is of the greatest use to the investigator. Such specimens, however, are not open to the use of many, and to those who have no access to them, monographs are of prime importance.

It will be admitted that every enlightened and civilised country ought to concern itself with the description of its Fauna and Flora. Quite apart from an economic point of view, it is incumbent on us to help forward the progress of knowledge, and to accumulate materials for comparing present living forms with those varieties which may proceed from them in future years; and these materials will assist in the elucidation of some of the far-reaching developmental problems under discussion at the present time.

No coloured monograph of the British Cicadæ exists, and it is even believed that no adequately illustrated monograph exists of European species. Partly to meet this want, it is proposed to publish eight quarterly Parts, each containing on an average ten litho-chromo plates and letterpress, illustrating the forms, metamorphoses, general anatomy, and the chief details connected with the life-history of this family of insects.

The work will contain also short diagnoses of all the British species, about 230 in number, most of which have come under the author's notice, each species being illustrated by one or more coloured drawings. Some account will be given of the curious myths and tales told by ancient Greek and Latin poets, and descriptions will be appended relating to the curious sound-organs possessed by some species, and other subjects connected with the economy of this interesting but difficult group of Rhynchotous insects.

It is believed that by the help of the numerous camera-lucida drawings, which will appear in this Monograph, many of which have been made from type specimens in the cabinets of Mr. J. W. Douglas and Mr. James Edwards, the identification of nearly-allied species will be facilitated.

TEMPORARY PREFACE.

Some apology may be thought necessary for the publication of the present Monograph. It is not supposed that it will lessen the value of existing memoirs on this group of the Hemiptera-Homoptera, such as those of Stål, Fieber, Sahlberg, and Edwards, but rather that it will facilitate study of the group, by enlarged portraitures of its species, and by a selection of the more important results obtained by authors of the last half century.

In the interests of Science, all work is open to criticism; but those who know the difficulties of an intricate synonymy—involving in almost every case patient comparisons, necessarily conducted under the microscope—will not hastily condemn possible errors in judgment in the identification of British with foreign forms.

To such a discriminating and not unkindly public, the Author commends his endeavours.

WEST, NEWMAN AND CO., PRINTERS, HATTON GARDEN, LONDON, E.C.

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T942

April, 1890.] [In Eight Parts.—Part II.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,

MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

London

MACMILLAN AND CO.

AND NEW YORK

1890

Price Eight Shillings

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ABBREVIATED TITLES OF THE WORKS OF AUTHORS QUOTED IN SYNONYMS OF SPECIES.

Am. et Ser. ... Amyot et Serville. Histoire naturelle des Insectes; Hemiptères. Paris, 1843.

Boh. ..... Boheman. Nya Svenska Homoptera, i Kongl. Vetenskaps-Akademiens Handlingar, 1845. Stockholm, 1847.

Burm. ..... Burmeister. Handbuch der Entomologie, Band. II. Berlin, 1835.

DeGeer ..... DeGeer. Abhandlungen zur Geschichte der Insecten. 1780.

Doug. ..... Douglas, J. W. *Vide* numerous notices on Cicadinæ in Ent. Mo. Mag. from 1876 to 1889.

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Fab. ..... Fabricius. Entomologia Systematica, Tom. iv. 1794.

Fall. ..... Fallén. Acta Holmensia för 1805 och 1806. Hemiptera Sveciæ. 1829.

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„ *S. T.* ... Fieber. Synopse d. Arten Tettigometra. 1865.

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Sch. ..... Schrank. Fauna Boica. 1801.

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Hemip. Sibariens. 1858.

Walk. ..... Walker, F. Catalogue of British Homopterinæ. 1850.

West. ..... Westwood, J. W. Mod. Class. of Insects. 1845.

Zett. ..... Zetterstedt. Insecta Lapponica.

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All that summer hours produce,
Fertile made with early juice.
Man for thee doth sow and plough,
Farmer he and landlord thou.
Thou dost innocently enjoy,
Nor dost thy luxury destroy;
The shepherd gladly heareth thee
More harmonious than he.
Thee country hinds with gladness hear
Prophet of the ripen'd year.
Thee Phœbus loves, and doth inspire,
Phœbus is himself thy sire.
To thee of all things upon earth
Life is no longer than thy mirth.
Happy insect, happy thou,
Dost neither age nor winter know;
But when thou'st drunk and danced and sung
Thy fill the flow'ry leaves among,
Voluptuous and wise withal,
Epicurean animal!
Sated with thy summer feast,
Thou retir'st to endless rest."

Lord Tennyson, with his usual accuracy in Natural History, as well as in astronomical observation, clearly discriminates between the Cicada and the Grasshopper. He gives in 'Œnone' a fine picture suggesting the sultry summer heat:—

"The grasshopper is silent in the grass,
The lizard with his shadow in the sun
Rests like a shadow, and the cicala sleeps."

Again, in 'Mariana in the South,'—

"At eve a dry cicala sung,—
There came a sound as of the sea."

and, once again, we have in his early poem, 'The Dirge,'—

"The balm cricket carols clear."

On which Dr. Murray suggests to me, as a clue, "baum- or tree-cricket;" but now I have good reason to know that the cricket of the hearth, which feeds on meal or balm, amongst other things, was the insect meant, and no "tree-singer."

Prof. Rupert Jones reminds me of the following

lines, which give the sense of soothing to the word "balm":—

> "This rest might yet have balm'd thy broken senses."
> *King Lear*, iii., Sc. 6.

> "All stars drop
> Balm-dews to bathe thy feet."
> *The Talking Oak.*

Browning, in his poem of eighteen stanzas, called 'A Tale,' alludes to the before-mentioned contest of Greek lyrists, but the incident as to the broken string is humorously and somewhat profanely treated:—

> "All was lost, then! No! a cricket
> (What 'Cicada'? Pooh!)
> —Some mad thing that left its thicket
> For mere love of music—flew
> With its little heart on fire,
> Lighted on the crippled lyre."

In England there is a very general confusion between the common Grasshopper and the Cicada. This confusion is kept alive by even able writers. A contributor to the 'National Review' of July, 1888, not ungracefully describes an English country village, as seen on a sultry summer's day. He writes:—"The bees have ceased from their murmurings amongst the king-cups and the clover. The wakeful Cicadas, as though in sympathy with sleeping Nature, have desisted from their querulous monotone," &c.*

With reference to keeping these insects for pets or toys, I may state that the boys of Foochow, in the central parts of China, are adepts at catching large Cicadæ by means of a long slip of bamboo, cleft at one end. The Cicadæ sit on the branches of the pine trees, and they also affect the twigs of a tree, known, amongst Europeans, as the Pride of India. The insects, I am informed, submit to be tickled like trout, until dexterously a leg is entangled in the bamboo slit, from which the creatures are transferred to small wicker

* Mr. J. D. Bouchier,

cages. Here, unconcerned with their confinement, or else from mere excitement, they sing almost incessantly. The "little beasts" in their cages are suspended round the children's necks, who seem delighted with the screeching music.

In some parts of Italy I am also told that boys fly them with light strings, like kites, for a time, and afterwards return them to their cages.

In illustration of the interest shown by the Greeks in the Tettix, I have placed on my first plate drawings of three pieces of Athenian money, to which the following explanations and descriptions apply.

The symbolism and significance of the Tettix have been already noted; but here it may be additionally stated that, in Grecian effeminate times, golden Tettiges apparently were worn in the hair as ornaments by both men and women, and they were stored amongst the valuable treasures of the Parthenon. Probably many of these ornaments were given as votive offerings. The Tettix was symbolically used, even after the time of Thucydides, in those mysteries where archaic forms were still preserved.

Although no city equalled Athens in its appreciation of Fine Art, it is remarkable that it allowed other cities to excel it in the beauty and stamping of their coins. Thus the coins of Syracuse—the productions doubtless of Greek artists—are the more famous, and they show probably more skill in execution; but it is not unlikely that the Athenians were averse to alter the effigies, &c., on their ancient money, from the circumstance that it was a recognised medium of exchange throughout commerce.

Description of Three Coins stamped with the Tettix.

The obverse of the silver tetradrachm shows the usual helmeted head of Athena, whilst the reverse represents the owl, sacred to her, standing on a vase

which represents the prize awarded to the winner at the Pan-Athenaic Games for that year. On this vase a letter was generally stamped, signifying the month of the issue of the coin by the mint-master, who placed his initials below.

On the right side, or place of honour, the chief magistrate for the year inscribed his name; and on the left side his two subordinates attached theirs. The chief magistrate also was privileged to place his private mark, symbol, or crest below his name. This symbol might be a bee, the prow of a ship, a figure of victory, &c. In the example here drawn Lysander appears as the magistrate, and his symbol is a Tettix. The names of the sub-magistrates, marked below on the tetradrachm, are Glaukos and Nicanor. The upper letters stand for AΘENĀ or AΘENE, for long after the introduction of the long eta the archaic epsilon was retained. The olive branch, partly circling the edge, symbolises the richness of the country around Athens.

The Tettiges on the two small pieces of bronze money, figs. 4 and 6, also indicate the dates of the latter. The Athenians looked with scorn on what we vulgarly call "coppers"—hence, perhaps, the poor execution and the defective stamping of these hemidrachms.

Bibliographic Sketch of the chief Modern Authors who have written on the Cicadinæ.

The first author of note who possesses any claim to accuracy appears to be the before-noticed Thomas Moufat, who in 1634 printed his 'Theatrum Insectorum ad vivum expressis iconibus supra quingentis illustratum.'

This curious book is somewhat rare, therefore a short account may be here given of the scope of his work. He commences with a bibliographic list of three hundred and ninety names, quoting from Moses downwards, through Aristotle, to Galen and Linacre.

Cicadæ seem to have been somewhat his favourite entomological study, for he gives us ten full pages relating to their ancient and then-known history. Much of his book is occupied with the fables and the allusions of classic authors.

Probably on account of the Cicadæ possessing a long proboscis and showing some other affinities, Moufat groups them with the Hemipterous water-insect, *Notonecta*, which generic word, *he* says, is derived from "Hyptionecticen," because they have learnt to swim on their backs. Now that an aquatic Cicada has recently been discovered in Australia, it is interesting to read a phrase with reference to the "water-boatman" written 250 years ago:—"Cicadæ aquatici formam descriptam retinent." Moufat's illustrations consist of nine rough wood-cuts of Cicadæ, all of which point to some large Indian forms, probably those imported from New Guinea by his cotemporary and friend, Dr. Louis Atmar.

Thomas Moufat, disgusted with the luxury of his day, partook of the Puritanic spirit then rising in England, which culminated in the asceticism of a later reign. He says we may profitably compare the nature of the Cicadæ with that of Man. The insects surpass us lords in virtues ("virtutibus dominos antecellunt, et nobis morum magistræ (mistresses ?) esse possint"), for *they* lead innocent lives, devour no living creature, and misuse nothing; whilst *we* convert things to wrong uses, and even act niggardly to our failing parents. The Cicada, frugal in his meal, wants no variety in his meat, nor makes curious mixtures of abominations in his dishes. What guest ends his feast like the Cicada! Then he inveighs against gluttony, "Yea! foul curiosity, born of folly, comes on men; so that they must mix together meats of contrary nature,—fruits, vegetables, aromatics, meats, and liquors, all are cooked together. Men gloat on the very act of swallowing, and hold in disgust the frugal but health-giving tables of the better sort;

but these insects quench their thirst in dewy water, whilst we the rather labour to excite it by alluring well-mixed cups. These creatures pass their summer in chanting cheerful songs to Heaven, but we, little men! ('homunculi'), basely lose our courage, and fear every turn of Fortune's wheel." *

Moufat was a true naturalist, and well loved the subject of which he treated. In his 'Epistola' he dilates on the pleasure felt by the operator who, by the skilful direction of the keen scalpel and dissecting needle, intelligently brings into view the wonderful resonating organs of the Cicada. He objects to the pretence of a Frenchman of his day (Réaumur?), who claimed the discovery of these organs, known long before, he points out, to Hesiod and to Aristotle.

Réaumur, in the tenth volume of his famous 'Mémoires des Insectes,' treats "sur les Cigales, et sur quelques mouches de genres approchant du leur." He says that the size of these insects alone would call attention to them, even if we disregarded their songs in harvest-time, "qui ne plait pas toujours." He says that in France he only knew of their occurrence in La Provence and Languedoc; though many observers have included certain kinds of grasshoppers (*sauterelles*) in the name Cigale, because they have a kind of song.

A friend who had some time before shown to Réaumur a complete slough of a large Cicada, was induced by the latter to search the ground for the living insects. Accordingly Réaumur received from him the next year several specimens of "les plus grandes Cigales de Provence," some of which were four inches in expanse of wing. These he figured in Plate 16 of his 'Memoires.' Amongst other things he remarks their large reticulated eyes, which in their reniform shape are not unlike those of the common crab. Likewise he calls attention to the three ocelli placed triangularly on the crown of the head. Although

* 'Theatrum Insectorum,' p. 129.

all the examples brought to him were dead, he remarks that the musical organs were not difficult of dissection.

Réaumur distinguishes three different species of "les grandes Cigales" in France; but there are, he notes, numerous smaller allied insects ("les Cigalons"), of which he attempts some classification, which is mainly dependent on their colour and variable markings. He roughly draws the compound ovipositor of the female with its curious saws ("les stigmates du corps") by which she channels the bark of trees or the stems of plants, thus forming grooves within which she deposits her eggs. There seems, however, to be some confusion in his description between the rostra and the ovipositors of these insects.

Malpighi mistook the sex of the singing insect, and curiously also he drew the complicated details of the ovipositor as appendages to the proper parts of the male organs.

Réaumur remarks, "Of course the notion of a true voice in insects is altogether erroneous." The song of the Cigale is neither "di testa" nor "di petto," but is entirely ventral. Still, he says, no air is respired. The musical organs in different species vary in size, whilst in other kinds they are entirely absent, having neither the large inferior scales nor the vibrating drums of the "chirpers."

A long and elaborate description is then given of the complicated diaphragms, with their attached muscles, and the kind of plectrum by which he declares the drums are made to vibrate; noticing, also, that long after the death of the insect, these organs (*timbales*) can be made to emit their sound by the scratching of a fine needle or by a shred of card.

Réaumur devotes ten pages of his 'Mémoires' to the anatomy of the saws and other parts of the insects. He scornfully attacks a certain M. Pontedera, who seems also to have been engaged in noting the habits of the Cigales, and who asserted that the female, after oviposition, filled the grooves she made for her eggs

with a resinous gum, suited to resist the effects of rain. Though this is contradicted by Réaumur, he afterwards admits that the female closes the furrows with woody fibres torn from the plant, by the action of her saws. The quarrel, though sharp, seems to have had something of the character of a "storm in a tea-cup."

Réaumur was well acquainted with the eggs of Cicadæ, but he failed to hatch them artificially. At one time he discovered some worm-like grubs, which at first he thought were the earliest forms of the insect, and that they were the produce of the above noted eggs. Afterwards he proved that these six-footed grubs were the immature forms of a predatory ichneumon-fly. In Réaumur's time Cicadas' eggs were eaten, and considered to be dainties, possessing, he says, a flavour equal to that of the ova of the cray-fish and lobster!

Baron De Geer, in 1780, gave descriptions of many small Cicadæ, which he illustrated by numerous woodcuts. Amongst other forms he describes *Cicada nervosa* (*Cixius*), and *Cicada cornuta* (*Centrotus*) of Linnæus, both of which insects are met with in Britain. His group of "Les petites Cigales" consists mostly of foreign insects, which it is now impossible to identify; but amongst the froth-making Cicadas he notes four, viz., *C. spumaria*, *C. salicis*, *C. grisea*, and *C. graminis*.

Cuckoo-spittle in his time was called *écume printanière* and also *crachat de grenouille*. In Sweden it was then known as *grots-spot*. He correctly affirms that this spume is voided from the anus. De Geer devotes Plate 12 of his 'Mémoire pour servir de l'histoire des Insectes' to "les Cigales." After describing several species, he observantly points out the peculiar append-ages to the last abdominal segments of the males of certain kinds. He divides the Cicadæ into five families, which, commencing with the Lantern-fly, passes to the true Cicadæ, thence to the horned Centrotus, through the Cercopidæ or spume-bearing

froghoppers, to the numerous small insects now comprised in the Jassidæ and other groups.

Swammerdam styled these smaller insects *Sauterelles-puces*. Linnæus divided the Cicadæ into sections which were chiefly ruled by the forms of the thorax, whilst Scopoli took into account the more or less coriaceous character of their elytra and wings. Fabricius at first constructed four genera, viz., *Membracis*, *Tettigonia*, *Cicada*, and *Cercopis*. To these he afterwards added *Flata* and *Delphax*. He enumerates many foreign and British species, but their identification is now almost impossible, from the shortness of the descriptions he gives.

Much valuable information may be got from Burmeister's 'Manual of Entomology,' an excellent translation of which was made by W. E. Shuckard in 1836. The book, however, labours under the disadvantage of containing no Index, and consequently every particular subject must be hunted up from chapter to chapter. In Burmeister's treatise, the "Cicadinæ" come under discussion in connection with their comparative anatomy. He groups them with insects of imperfect metamorphosis,—that is to say, with those having the larva, pupa, and imago active, and strongly resembling each other. The pupæ of Cicadinæ also possess locomotive powers, and are capable of eating. They belong to that branch of the Hemiptera which have suctorial mouths and homogenous elytra.

In Burmeister's 'Genera Insectorum' (Rhynchota, 1838), there is a pretty full description of the then accepted genera of the European Cicadinæ: the descriptions are supplemented by some beautifully coloured plates of the winged forms, which illustrate various genera.

Léon Dufour, amongst the numerous dissections of insects he made, published in 1833 some valuable engravings of the nervous, alimentary, and reproductive system of the foreign insect, *Cicada orni*. Notice of

his work will be deferred until a general sketch of the terminology of the family can be given.

Latreille also proposed a classification of these insects, and makes some interesting remarks upon the relations they bear to *Aphis* and to *Coccus*. Amongst the aberrant forms he notes that the members of the genus *Flata*, Fab., have often a close resemblance to the small Lepidoptera, "rassemblant à de petites Phalenes, ou mieux encore, à des Pyrales." Particularly in *Flata limbata* we find an example of suggestive affinity in the elongated antennæ, the farinose wings, &c. Thus this insect recedes from the Homopterous and approaches to the Lepidopterous type.

Dr. C. Fallen wrote in 1826 a treatise, 'Homoptera Sueciæ,' and, again later, another work entitled 'Cicadariæ Londini Gothor.,' which I have not seen.

Carolus Stål published four volumes on the African Hemiptera-Homoptera, from 1864 to 1866, the last volume of which he dedicated to Dr. Fieber. This work is little more than a catalogue of these insects, without any accompanying life-history. He notes numerous examples of the small silent Cicadæ, many of which are generically represented in Europe and Great Britain. Stål's work is chiefly useful to the student of British forms in a classificatory point of view. Stål also wrote numerous papers on the genera *Issus*, *Cixius*, *Philænus*, &c., from the years 1854 to 1869, all of which papers are previous to Fieber's work on the Cicadinæ, &c., in 1872.

It is to be remarked that in these tropical regions our own genera, *Delphax*, *Aphrophora*, *Tettigonia*, &c., do not seem to attain to larger dimensions than they do in temperate climates.

Prof. J. O. Westwood, in 1840, divided the Homoptera into three primary sections, based on the number of their tarsal joints:—1. Trimera (Cicada, &c.). 2. Dimera (Aphis, &c.). 3. Monomera (Coccus, &c.). His remarks on Cicada are well worthy of

perusal, as touching on the relative position and the natural history of the insect.*

Dr. Germar paid also much attention to this group; and in numerous memoirs in his 'Magazine of Entomology' (vols. iii. and iv.) he describes a great many species.

The only figured examples that we possess of British Cicadinæ are those drawn and engraved by J. Curtis, in the 'British Entomology,' from 1823 to 1840. Like the rest of his drawings, they are all beautifully executed and coloured. He engraves about sixteen figures in illustration of as many genera, but, if his figures may be criticised, the proportions of the insects are not always faultless. A diagnosis of the different species is given, but even with this help the species cannot always be decided on with certainty.

In 1858 the authorities of the British Museum published, under the superintendence of Francis Walker, a 'List of the Homopterous Insects in the National Collection.' Amongst these are numerous examples of Cicadinæ, the greater number of which, however, are foreign. The few British species are only incidentally mentioned. Mr. F. Walker makes three Orders, *viz.*, Cicadina, Phytothires, and Physopoda. In the first Order he includes the Cicadinæ under four Families. In the second he places *Psylla*, *Aphis*, and *Coccus*, and in the third *Thrips*. The above four Families of Cicadinæ are Stridulantia, Fulgorina, Membracina, and Cicadellina, all of which are represented by British insects. Mr. Walker's list probably requires a modern revision, with due reference to his type-specimens.

Dr. Flor published his 'Livonian Hemiptera' (Rhynchota Livlands) in 1861. Unfortunately none of the typical forms collected by him are now in existence. His work may be studied for the descriptions of the insects he names, but for want of figures the student is often plunged in doubt.

* See Westwood's 'Introduction,' p. 417.

The Austrian naturalist Dr. Franz Fieber issued in 1872 his 'Catalogue of the Cicadæ of Europe,' which work was to have been the precursor of a larger one. Unfortunately for Science Dr. Fieber never lived to complete his task. His unfinished papers came under the supervision of his friend Dr. Puton, who long sought a fitting opportunity for editing them. M. Ferd. Reiber finally purchased numerous papers of Dr. Fieber's widow, which he arranged and edited in French in 1875. Although portions of Fieber's work were lost, MM. Puton and Lethierry (the possessors of many of Fieber's drawings) supplied descriptions to the new genera erected by Fieber, and also diagnoses of such species as were missing.

Fieber points out, in his Preface, the difficulties which beset the student in his attempts to classify the Cicadinæ in a natural manner. He remarks that the neuration of the elytra and wings is of the first importance for the erection of the genera of Cicadinæ; but that the characters drawn from the forms of the head, the antennæ, the pro- and mesonotum, and the spurring and serratures of the legs, are also of material help towards forming sound conclusions. One essential character must not be overlooked. There exists in several genera a very remarkable diversity of form in the apparatus attached to the genitalia of both sexes. In many cases therefore difficult species may be separated by an adequate examination of the corneous styles, hooks, and coupling apparatus commonly found at the terminal abdominal rings of the males. In some tribes these styles are free, and can be seen with comparative ease, as in the Delphacidæ and the Deltocephalidæ, but in other tribes, like the Typhlocybidæ and the Jassidæ, they mostly are hidden, and require much patience and address to bring them into view. The coloration of the various species must not be neglected; still, from its great liability to variation, the value of its evidence sometimes is not very high.

Dr. Stål procured for Fieber's inspection type-

specimens of Swedish insects; and Fieber was also assisted by loans of insects named by Redtenbacher, Florren, Mayr, and Heller, and by John Scott in England. Reiber's French translation contains some valuable etchings of European Cicadinæ executed by Fieber himself; but as several drawings were missing from his collection at the time of his death, the plates could not be consecutively arranged in M. Reiber's translation. The loss of manuscript also may explain the absence of an Index, which would have proved a great help to find one's way. The first part of the Memoir describes one hundred and seven European genera. The second part describes the species comprised in the Membracidæ, the Cicadidæ, and the Issidæ; whilst the third and fourth parts deal with the Fulgoridæ up to *Stiroma*. Thus the Acocephalidæ and the Jassidæ are left undescribed. This hiatus has been in part filled up by M. Victor Signoret, who wrote an 'Essai sur les Jassides et les Acocephalides' of Stål and of Puton.

This general treatise was published in 1878, in the 'Ann. de la Soc. Ent. de France,' and is embellished with nine plates, with detailed drawings of the beforementioned genital plates and styles comprised in the pygophore. The 'Essai' describes many insects inhabiting the areas of Europe, India, Russia, North America, and Australia. The subject-matter therefore spreads over too large a field to be of much service to the specialist of British forms.

Another valuable work, entitled 'Notiser ur Sällskapets pro Fauna et Flora Fennica,' appeared at Helsingfors in 1871, written in Latin and Swedish, by John Sahlsberg. As the latitudes of Finland and Scandinavia are not very different from those of Great Britain, a large number of the smaller Cicadæ are common to the two countries. Sahlsberg's descriptions are clear, but they are too voluminous. The venation of the wings is well drawn, for thirty-five genera, and these outlines will be found to be a considerable help

in deciding to what group an insect under examination properly belongs. The elytra are not figured.

The reader is next referred to a series of memoirs written by the late Mr. John Scott, commencing with a paper entitled "A Review of the Family Delphacidæ, and Descriptions of several New Species, &c." This and other communications by the same author are scattered through the volumes of the 'Entomologist's Monthly Magazine,' commencing vol. vii., and continuing over the later ones till the year 1881. In cases of doubtful species Mr. Scott had the advantage of submitting them to the inspection of M. Lethierry, who, as before noted, had the possession of Fieber's drawings for reference.

I believe that the first systematic catalogue of British Hemiptera, including the Cicadaria and Phytothires, was compiled by Messrs. John William Douglas and John Scott, and published in 1876 by the Entomological Society of London. The portion referring to the Homoptera, commencing with the Fulgorinæ, catalogues, without describing, all the then-known British species with their synonyms, from genus *Cixius* through *Typhlocyba* to *Deltocephalus*.

These insects were mostly represented by examples in the cabinets of these authors. Through the great liberality of Mr. Douglas, who has granted to me the loan of many of his types, I am enabled to figure insects which probably I never otherwise could have obtained.

Unfortunately the late Mr. John Scott's collection has been broken up; some of the rarer species, it is believed, have been incorporated in the British National collection, but the larger portion of the rest has become the property of Mr. P. B. Mason, F.L.S., who, learning that I was interested, in the like liberal spirit consigned to my keeping for the purposes of comparison a considerable part of Mr. Scott's collection, duly labelled by Scott himself.

The only other British work of consequence treating

on this family is that of Mr. James Edwards, who has more completely made this subject his study perhaps than any other English writer. His 'Synopsis of British Homoptera-Cicadinæ' is the result of many years' observation and study.

A common objection to the descriptions of species is the inordinate length, not to say the verbosity, of their diagnoses; but in Mr. Edwards' tables we have a *multum in parvo*. Through them, after the genus has been clearly made out, a species may often be "run to earth" by a judicious elimination of characters, and by a proper bracketting off.

Here, again, considerable assistance has been afforded the author by his possession of numerous duplicate insects, all of which have been recently labelled and many captured by Mr. Edwards himself. The great advantage of comparison of insects with his types must be acknowledged by all.

It is possible that amongst the many species I have to describe, some mistakes may occur in the synonymy of foreign forms. For such errors the indulgence of foreign entomologists is asked.

The above enumeration of authors by no means exhausts the bibliography of the British Tettigidæ. Amongst other observers I would mention the late Dr. Franz Löw, of Vienna, who wrote several short memoirs on species. The titles of his works, and those of others, will be added to the end of this Monograph.

CLASSIFICATION.

Zoological Classification has been mainly based on the significance of those organs which appear to be of the highest importance towards promoting the animal economy, and for effecting the reproductive functions. Such classificatory schemes may be denominated Systems.

Of those urged by authors several are noteworthy, but the chief of these relating to insects may be comprised under one of the following heads:—

I. *Metamorphic*, advocated by Swammerdam and Lamarck, which deals principally with larval changes.

II. *Cibarian*, advocated by Fabricius, which deals chiefly with the anatomy of the mouth parts.

III. *Alary*, employed by Linnæus and De Geer, who laid stress on the importance of the wing-veining and the development of its details.

But however convenient such systems may be, we have no sure proof that they are natural; for sometimes animals, and not excepting insects which are nearly allied to each other in form, materially differ in their habits and metamorphoses; and such exceptional examples do not accommodate themselves to schemes which some have hence thought arbitrary and unreal.

In erecting a Natural Biological System numerous considerations must be taken into account. Not only should physical form, colour, modes of reproduction, and life-economy be taken into thought, but to these must be added the important but difficult questions rising out of Phyllogeny and modern Ætiology, which last study treats of the laws of variation.

Our certain knowledge of the descent of group from group shadowed forth in the phenomena of Embryology, and the results of discovery bearing on the laws of variation, are as yet too scanty to help us much, as simple systematists.

But it is more easy to point out defects in systems than to construct others on more natural bases. Examples of such difficulties are not hard to find. Thus amongst insects we find Lepidoptera with mandibulate larvæ and proboscidean imagos; yet the latter may not be classed with the Rhynchota. Again, in the Ephemeridæ we find most commonly four-winged, and more rarely two-winged, imagos; yet the last are not Diptera. Amongst the Vertebrata we might expect to find in a genus a constant in the number of vertebræ; yet amongst pigeons we have strange anomalies in this respect, and we find discrepancies even amongst

Pronotum nearly twice the length of the head, with orange streaks and pale keels, which do not reach to the hind margin of the same. Abdomen dark orange, with black dots at the sides. Dorsum black, with dark segmental marks. Elytra two and a half times longer than the abdomen; yellow, with blackish nervures. Apical portion rich brown, which colour tapers towards the basal end. Wings grey, with brown nervures.

The point of the serrated ovipositor protrudes beyond the end of the pygofer. This organ, with its sheaths when seen from below, is imbedded in a tuft of cotton-like fibre.

This insect is marked uncommon by Mr. Edwards, but it has been repeatedly taken in the autumn by Dr. Capron, in the Gomshall marshes, near Guildford.

	Inches.	Millimètres.
Expanse	0·48	12·0
Size	0·2×0·07	3·0×1·9

LIBURNIA SCOTTI, *Fieb.* Plate X., figs. 6 to 8.

Kelisia Scotti, Fieb., C. E. pt. iii. 18.
Delphax pallidulus, Marsh.
Liburnia Scotti, Scott; Edw. pt. i. 66.

Head relatively shorter than that of all the former-named species. Gulæ each with a small black spot. General colour throughout, fulvous-yellow. Head rather darker than the rest of the body. Pronotum almost spotless, with faint keels, which do not reach to the posterior edge of the pronotum. Elytra variable in length; fulvous, with a crescentic brown mark at the apex. Sometimes this streak spreads into a blotch, and the membrane is suffused with brown. Apical cells four or five. Legs ochreous-yellow, edges of the laminated spur on the tibiæ with black serratures. Under-side uniformly yellow. Abdominal apex of the female truncated, with an obtuse, blunt, anal style. This sex sometimes shows a tendency to develop faint barrings on the dorsum. The male is smaller, and the

above-noted streaks appear more as broad dots. A small dot occurs on the outer edge of the clavus. The genital segment is posteriorly of a snowy white.

Found in marshes near the Norfolk Broads and elsewhere. Fieber records it as found in Germany, on rose trees.

	Inch.	Millimètres.
Expanse	0·26	6·60
Body with wings	0·13	3·30

Liburnia smaragdula, *Stal.* Plate XI., figs. 1 to 4.

Delphax smaragdula, Stål; Kirschb.
Liburnia smaragdula, Scott.
Chloriona smaragdula, Fieb., G. D. t. 8, fig. 6; Fieb., C. E. pt. iii. 26; Sahl.; Edw. pt. i. 66.

Vertex projecting beyond the head, strongly keeled, and brownish. Antennal second joint large. Pronotum bright green. Keels somewhat indistinct. Abdomen brown, with dusky ochreous somatic rings and reddish sides. Pygofer of the female ending with two greenish square opercular plates. Legs emerald-green, with minute black hairs on the spurs of the hind tibiæ. Elytra long, rounded at the apices; colour pale green, shading into yellow at their bases. Nervures yellow and pale, furnished with fine hairs. Wings delicate and iridescent.

The brachypterous female is larger than the macropterous, with elytra hardly one-third the length of the abdomen. Wings obsolete. General shape fusiform, with swollen body-rings. Pygofer notched, with a rounded anal process, beneath which the black point of the ovipositor appears.

This insect is rather uncommon in England, but it occurs in the environs of Stockholm. It has been taken also at Sarepta, in Syria.

Size, 4·5 to 5·0 millimètres, or 0·16 to 0·18 inch.

LIBURNIA UNICOLOR, *H.-S.* Plate XI., fig. 5.

Delphax unicolor, Schäff.
Chloriona unicolor, Fieb., G. D. t. 8, fig. 5, and C. E. pt. iii. 27; Sahl.
Liburnia unicolor, Scott; Edw. pt. i. 67.

Long. Macropterous male greenish white, with pale greenish vertical and pronotal keels. Scutellum long, pale, and dirty white. Eyes brown. Elytra long and greenish, with very delicately marked brown nervures. Abdomen black. Legs concolorous with the elytra. The scutellum of the male is much longer than that of the female. Pygofer sometimes whitish (Edwards).

Found on reeds, *Arundo Phragmites*, from June to August. Taken at Black Gang Chine, Isle of Wight, and also at Lucerne, Switzerland.

Fieber places these last two species, with three others not British, in a separate genus, but the characters hardly seem to be sufficiently distinct to justify such a proceeding. The vertices of the last two insects are long, but not so long as those previously described.

Size, with elytra, 4·5 to 5·0 millimètres, or 0·17 to 0·19 inch.

LIBURNIA COLLINA, *Boh.* Plate XI., fig. 6.

Delphax collina, Boh.; Flor; Marsh.; Kirschb.
,, *pallens*, Fieb., G. D. t. 8, fig. 27.
Liburnia collina, Scott; Sahl.; Fieb., C. E. pt. iv. 19, 16; Edw. pt. i. 67.

Macropterous male. General colour pale yellow, with indistinct fuscous markings. Vertex hardly protruding beyond the eyes. Keels whitish. Scutellum longer than the pronotum. Legs ochreous. Elytra pale yellow, with round apices; length more than one and a half greater than the abdomen. Frons with a brown or black ground and whitish keels which appear above the vertex.

Brachypterous female stout. Head broad, showing the carinations distinctly; the middle keel being carried through to the apex of the scutellum. Abdomen brown or rusty red, with sundry brown segmental spots. Legs greenish. Elytra not more than half the length of the abdomen. Nervures coarse; edges of the elytra bordered with white.

The Brachypterous male is smaller than the female, with a square truncated pygofer and curiously hooked styles.

The Macropterous male figured in my plate was taken on Malvern Beacon in July.

Size, with elytra, 3·0 millimètres, or 0·12 inch.

Very generally scattered over the North of Europe. Habitats in Germany, France, Austria, Styria, and Switzerland.

Liburnia elegantula, *Boh.* Plate XI., figs. 7 to 11.

Delphax elegantula, Boh.; Flor; Marsh.; Kirschb.; Fieb., G. D. t. 8, fig. 22 (♂ genitalia).
Liburnia elegantula, Scott; Sahl.; Fieb., C. E. pt. iv. 7; Edw. pt. i. 68.
Liburnia æmulator, Scott.

Long. Dark brown. Head and eyes broad. Vertex greyish white. Keels distinctly seen on the crown. Pronotum white, with two dark dashes behind the eyes more or less confluent. Scutellum black. Abdomen ochreous, with brown transverse streaks, and a dark lateral band carried on each side to the apex of the pygofer. Elytra of the brachypterous forms greyish white, with yellowish punctate nervures, and of a length about half that of the abdomen. Antennæ and legs yellow and concolorous. Pygofer of the male, as seen below, with a semilunar valve and rounded dorsal plates. Styles sharp and divergent.

I have not met with the Macropterous form. Mr. Edwards describes it, "Scutellum twice the length of

the pronotum. Elytra one-half longer than the abdomen; nerves dirty white."

Size, 3·5 millimètres, or 0·14 inch. The middle keel of the frons furcates before it passes on to the vertex.

My figures are taken from specimens liberally lent to me by Mr. J. W. Douglas.

LIBURNIA LEPIDA, *Boh.* Plate XII., figs. 1 to 4.

Delphax lepida, Boh.; Kirschb.; Fieb., G. D. t. 8, fig. 36.
Delphax tristis, Boh.
Liburnia lepida, Scott; Sahl.; Fieb., C. E. pt. iv. 32; Edw. pt. i. 74.

Macropterous form small, with vertex squarish and projecting. Eyes reddish. Antennæ orange-coloured. Head and pronotum brown, with white keels, which are continued down to the posterior margin of the scutellum. Abdomen dark brown. Elytra delicate and milky-white; nervures spotted with many brown dots. A broadish, dark, irregular, wavy line passes inwards from the apical edge, and a similar one passes across the costal edge. A blotch usually occurs at the margin of the clavus. Legs brown, with several white rings. Tarsi orange.

The Brachypterous female is larger and more robust. Elytra half the length of the abdomen, and vandyked with white and brown at their apices. Veins white and coarse, marked by five or six black dots. Abdominal rings swollen, and obscurely marked with yellowish blotches.

The Brachypterous male is small, brown, with yellow keels. Apical border of elytra white. The pygofer is blunt, with a notched crescentic border. Anal process yellow and obtuse, with sharp sickle-shaped styles.

	Inch.	Millimètres.
Expanse	0·260	6·60
Size	0·12	3·0

LIBURNIA GUTTULA, *Germ.* Plate XII., figs. 5 to 8.

Delphax guttula, Germ.; Curt.; Flor; Marsh.; Kirsch.
Kelisia guttula, Fieb., G. D. t. 8, fig. 4, and C. E. pt. iii. 22.
Liburnia guttula, Scott; Edw. pt. i. 64, fig. 13, pl. ii.
Stenocarenus guttula, Sahlb.

Brachypterous form, with vertex, pronotum, and scutellum almost concolorous yellow. The sides of the pronotum sometimes seen with faintish dark markings. Legs ochreous-yellow.

Macropterous form: — General colour ochreous. Vertex square and rather prominent before the eyes. Posterior margin of the pronotum sinuous. Scutellum about equal in length to the pronotum. Keels faintly marked.

Abdomen robust, with several slender transverse streaks. Pygofer with very complex appendages. The male genitalia long and prominent. The anal process ends with a peculiar oval, notched, tubercle. Styles gladiiform. The penis is curved like the coiled vernation of some ferns, and there are also added to this apparatus two long setiform organs, all of which details are enclosed in a spatulous sheath, inserted between two valvular plates. Elytra transparent and colourless, with yellow nervures, and a black triangular patch at the apex, giving to the insect its specific name.

L. guttula in many respects resembles *L. vittipennis*, but there are several differences of note. The anal process is somewhat like in both insects, but the genitalia differ, as may be seen in Plate X., figs. 3 to 5, and Plate XII., figs. 7 and 8. *L. vittipennis* also is a larger insect, has longer wings, and also has more pronounced thoracic markings.

The Macropterous form is rarely met with in England. My drawing is from a specimen taken by Mr. Edwards, at Stratton Strawless, in Norfolk.

Fieber gives for a character "Sur les joues une grande tache carrée," and he notes Sweden, Livonia, Germany, France, and Switzerland—"in dry meadows near mountains, from April to October"—for their habitats.

Size, 2·75 millimètres, or 0·11 inch.

LIBURNIA ADELA, *Flor*. Plate XII., figs. 9 to 11.

Delphax adela, Flor; Fieb., G. D. t. 8, fig. 50 (♂ genitalia).
Liburnia adela, Scott; Fieb., C. E. pt. iv. 54; Edw. pt. i. 71.

Macropterous male. Colour ochreous-brown. Keels on the head and pronotum grey and distinct; those on the last carried to the base of the scutellum. Eyes black. Elytra reaching to the apex of the abdomen, with a free, narrow, apical margin. Nervures fine and brown, studded with minute black dots. Abdomen ringed with pale brown. Pygofer obtuse from above, and ending with a black anal style. Legs concolorous with the antennæ. Frons usually black or dark brown, with a pale central keel forked just before the vertex. Styles flat and ribbon-like, twisted, with square ends and pilose outer edges.

Size, 0·20×0·60 inch, or 3·04×1·52 millimètres.

The occurrence of the female has not been noted either in Britain or France.

LIBURNIA FIEBERI, *Douglas & Scott*. Fieb., G. D. t. 8, fig. 50, C. E. pt. iv. 32; Edw. pt. i. 75.
Plate XII., fig. 12.

Liburnia Fieberi, Scott, Ent. Mo. Mag. vii. 70, 25; Fieb., C. E. pt. iv. 33; Edw. pt. i. 75.

Brachelytrous male. Small, oval. Head and vertex honey-yellow. Eyes grey. Pronotum with a triangular

brown patch on each side, and with yellow in the midst. Keels pale. Scutellum yellow. Abdomen large, cylindrical, and ochreous-brown, with a brownish violet stripe at each side, which widens as it descends to the pygofer. Apex cleft, with a roundish notch, and style within the notch. Elytra oval, and from one-half to one-third only of the length of the abdomen. Colour warm brown, with dark edges and paler nervures. Wings lanceolate and very small. Legs and antennæ concolorous yellow, as is also the whole of the under side of the insect.

Fieber notes two white semicircular spots, which enclose a black marginal one. The margins and interior apical angles of the elytra blackish brown.

Size, 0·11×0·50 inch, or 2·79×1·27 millimètres.

Taken on commons amidst sedges and rushes, in October. Only the brachelytrous males and females have yet been recorded in Great Britain.

Liburnia Signoreti, *Scott.* Fieb., C. E. pt. iv. 55; Edw. pt. i. 70.

Plate XII., fig. 13.

Male. Head, pronotum, and scutellum dirty yellowish brown. Vertex square. Frontal keels pale, the central one being forked near the vertex. The pronotum shorter than the vertex; the scutellum a little longer. Elytra equal in length to the abdomen. Styles pilose and "apparently strap-shaped; slightly widened at their sub-truncate apex; their upper half upright, and slightly curved backwards."—(Edwards. See his Plate I., fig. 7, and Plate II., fig. 15.)

The brachelytrous female is semi-globular, uniformly dirty yellow, with obscurely marked spots on the somatic rings. The elytra are about two-thirds of the length of the very rotund abdomen; nervures brown, and finely dotted with black. The tail ends with two brown recurved styles.

Marshes in Abbey Wood; and at Brundall, Norfolk. June.

Size, 2·75 to 3·00 millimètres, 0·11×0·15 inch.

LIBURNIA VENOSA, *Germ.* Plate XII., fig. 14.

Delphax venosa, Germ.
,, *rhypara*, Flor.
,, *nitidula*, Kirschb.
Liburnia venosa, Scott; Fieb., C. E. pt. iv. 35; Edw. pt. i. 83.
,, *curtula*, Sahlb.

Brachelytrous form: — Small; brown or black. Vertex square. Eyes black. Head with two dark lines united behind the eyes. Pronotum obscure brown, with pale keels. Scutellum rather longer than the pronotum. Elytra nearly equal to the length of the abdomen, oval, with coarse brown veins. Abdomen obscure brown, with a yellow pygofer and two black anal plates. Legs and antennæ yellowish; tibiæ large and furnished with two spines on the outer edges, and armed with the usual laminæ.

I have not met with the Macropterous form; but Mr. Edwards describes it as having "dirty whitish hyaline and wrinkled elytra, nearly twice the length of the abdomen."

Found on the roots of coarse grasses and rushes. The female is larger than the male.

Size, 2·00 millimètres, or 0·08 inch.

LIBURNIA CAPNODES, *Scott.* Plate XIII., figs. 1 to 6.

Liburnia capnodes, Scott; Fieb., C. E. pt. iv. 41; Edw. pt. i. 73.

Macropterous female. Vertex rounded in front, yellow, with two or more brownish dots. Pronotum with three pale keels, and scutellum dirty yellow, with

several dark dashes. The former sometimes projects over the latter like a hood or scale. Elytra pale brown, rather longer than the abdomen, and marked by fine nervures set with bulbose setæ. Abdomen ridged with yellow edges to the segments. End of pygofer yellow and semi-arcuate. Legs fuscous, with dark claws. The wings are obsolete.

Macropterous male. Colour very similar to the female. The elytra and the wings are fully developed, and rather longer than the abdomen. The pygofer seen in profile is square, with a small projecting anal tube and pointed genital styles. The costa and the apical borders of the elytra are very stout, and transversely striated, as if ringed. In a less degree this thickening is to be seen in the wings also. The frons is dark between the keels, which are obvious, and not forked at the vertex. Legs stout, with rather short tarsi.

A single Macropterous male was taken by the author in Romney Marsh in June, and a female afterwards on the banks of a stream near Chichester. The male has not been described before. It has its wings fully developed.

	Inch.	Millimètres.
Expanse	0·16	4·06
Size of body	0·10×0·04	2·54×1·01

This insect may be compared with *L. adela*, which it rather resembles.

LIBURNIA PALLIDULA, *Boheman*. Plate XIII., figs. 7 to 10.

Delphax pallidula, Boh.; Flor; Kirsch.
,, *punctulum*, Kirschb.
Liburnia pallidula, Scott; Edw. pt. i. 65.
Stenocarenus pallidulus, Sahlb.
Kelisia pallidula, Fieb., C. E. pt. iii. 17, 2.

This species varies much in its marking, its form, and its proportions. The general colour partakes of

many shades, from white to yellow and to pale brown. The white variety shows the vertex slightly projecting beyond the dark grey eyes.

Antennæ white, with brown tips to the second joints. Pronotum white, with a thin angular mark above the posterior edge of the scutellum. Post-scutellum large, and often marked with an orange spot. Abdomen white and almost immaculate, with two large laminæ in the males, which project beyond the abdominal apex. Legs ochreous-yellow. Elytra white, with four coarse greyish nervures, and a dark forked nervure on the clavus. Wings obsolete, and mostly represented by two small membranous lobes. The abdomen in some specimens is stained with orange, and the eyes black.

The male has the abdomen barred with brown, and the elytra darker. The pygofer is of a complex type, and shows details very like those of *L. vittipennis* and *L. guttula* (*vide* Plates X. and XII.). The peculiar penis and the funnel-shaped anal process with its styles may be compared with Plate XII., fig. 8.

Late in September the female contains from three to six eggs. Before oviposition they are green, oval, and placed centrally; with the most mature ovum close to the entrance of the oviduct, and near to the attachment of the saws and sheaths, which, when folded together, act as an ovipositor. These ova are very large (0·03 to 0·01 inch), but not so disproportionately so to the abdomen of the insect, as we find in the oviparous female Aphides. The oviducts must be very elastic to allow such large bodies to pass. The point of the ovipositor protrudes from the centre of the funnel, and close to the anal process, with its appropriate style.

The variety named *Delphax punctulum* by Kirschbaum shows two black dots on the head and two dots on the gulæ or cheeks. The elytra of his insect also are darker in their nervures and membranes than shown by my specimens.

These insects inhabit marshy land. Fieber says in Germany it is taken (sporadically ?) on the rose tree.

	Inch.	Millimètres.
Wings expanded	0·19	4·80
,, closed	0·10×0·04	2·54×1·02

Liburnia scutellata, *Scott.* Edw. pt. i. 73. Plate XIII., figs. 11 and 12.

Macropterous male small. Head brown, with three distinct yellow keels. Eyes black. Pronotum yellow, with two brown stripes continued to the hind border. Two dark patches under the base of the scutellum. Abdomen black, both above and below, the upper rings bordered with reddish yellow. Pygofer black and orange; styles black and hooked. Legs dirty yellow. Elytra yellowish and longer than the abdomen. Rounded at the tips, encircling which and the claval border there runs a strong dark nervure. Other nervures brown. Wings hyaline, with the two upper radials stouter than the rest.

This insect is smaller than *L. Fairmairei*, which in some respects it resembles. My figure is from Mr. Douglas's collection. The insect is rare.

	Inch.	Millimètres.
Expanse	0·26	6·60
Size with elytra closed	0·90	2·27

Liburnia leptosoma, *Flor.* Plate XIII., fig. 13.

Delphax leptosoma, Flor; Marsh.; Fieb., G. D. t. 8, [fig. 34.
,, *Heydenii*, Kirschb.
,, *albo-limbata*, Kirschb.
,, *albo-fimbriata*, Fieb., G. D. t. 8, fig. 35.
Liburnia leptosoma, Scott; Fieb., C. E. pt. iv. 29; Edw. pt. i. 77.
Liburnia albo-fimbriata, Scott.

This insect has been as yet only described in the undeveloped form.

Male. Vertex dirty ochreous-yellow; the rest of the upper side black, except the posterior margin of the elytra, which is white. Elytra half the length of the abdomen; the lower border rounded. Pygofer black and notched, the base being concealed beneath the preceding somatic ring.

Female with the vertex yellowish and square, not protuberant. Pronotum and scutellum with faint yellow carinæ. Abdomen dark brown. Elytra like those of the male. Legs and the antennæ dirty ochreous-yellow. Frons black.

Fieber figures the genitalia of *L. leptosoma* and *L. albo-fimbriata;* but a comparison of his drawings does not show, from this cause alone, a sufficient reason for specifically separating these two insects. Mr. Edwards marks this delphacid as common in Britain. It also occurs in France, Germany, and Switzerland.

Size, 0·08 to 0·10 inch, or 2·08 to 2·75 millimètres.

Liburnia lugubrina, *Boh.* Plate XIV., figs. 1, 2.

Delphax lugubrina, Boh.; Flor; Kirschb.; Fieb., G. D. t. 8, fig. 39.

Liburnia lugubrina, Scott; Fieb., C. E. pt. iv. 43, 38; Edw. pt. i. 76.

Brachypterous female large, fusiform; general colour ochreous yellow, slightly varied by pale brown markings down the pronotum and the scutellum. Eyes dark brown. Tips of the tibiæ black. Pronotum and the scutellum, taken together, one and a half times greater in length than the head. Edges of the elytra and the body-rings paler. Tibial laminated spur large.

Male macropterous form with scutellum nearly three times the length of the abdomen. Nervures non-granulate. Pygophore transversely quadrangular when viewed from behind; sinuous and notched at the base.

Styles divergent, and placed about mid-height of the opening of the pygofer; lanceolate, acuminate, and hooked (*vide* Plate XIV., fig. 2, and Plate XVIII., figs. 2 *a* and 2 *b*).

The male insect, under a weak lens, has somewhat the appearance of *L. discolor*, but its elytra are much darker, and they are edged with yellowish white. The vertex, also, is more prominent than in *discolor*. In some respects, also, this insect resembles *L. straminea*, but the pygofer and its adjuncts differ. The styles of *L. straminea* are blunt, not lanceolate. This insect may be often taken in damp meadows during June and July.

	Inch.	Millimètres.
Size of Macropterous male	0·09	2·50
With expanded elytra	0·20	5·25

Found pretty generally distributed over the central parts of Europe.

LIBURNIA DISTINCTA, *Flor*. Plate XIV., fig. 3.

Delphax distincta, Flor; Fieb., G. D. t. 8, fig. 23.
Liburnia distincta, Scott; Fieb., pt. iv. 11, 9; Edw. [pt. i. 69.
,, *albo-carinata*, Sahlb.
,, *consanguinea*, Scott; Douglas.

Brachypterous female. Vertex black, projected beyond the eyes, and strongly marked with white keels. Two yellow spots occur near the pronotum. Scutellum and pronotum dun-brown, with the usual keel-marks paler, and carried through to the lower border. Abdomen rich brown, with five well-marked somatic rings, and a deeply-cleft pygofer. Elytra about half the length of the abdomen, with apices rounded, yellowish, with pale, smooth, whitish nervures. A row of dark spots runs down each side (Edw.). The male is smaller and altogether blacker than the female.

The Macropterous male has its elytra more than one-half longer than the abdomen. Apices truncate and round. My figure is from an example kindly lent to me by Mr. Douglas.

	Inch.	Millimetres.
Size of male	0·10×0·04	2·54×0·02
,, female	0·11×0·05	2·79×1·27

LIBURNIA PULLULA, *Boh.* Plate XIV., figs. 4, 5.

Delphax pullula, Boh.; Stål; Fieb., G. D. t. 8, fig. 39.
Liburnia pullula, Scott; Sahlb.; Fieb., C. E. pt. iv. 42; Edw. pt. i. 75.

Very small. General colour dirty ochreous-yellow. Head round in front, with a brownish vertex. Eyes black. Pronotum and scutellum together about one-third longer than the head. Abdomen short, conical, and ringed, with an obtuse pygofer, and long oval aperture containing short black styles, and a deltoid anal opening. Elytra very short, ovoid, and of a brown colour, marked by coarse dark nervures. Legs and antennæ pale ochreous.

I have not met with the Macropterous male, but it is described as having the pronotum with side keels distinct and curved outwards; elytra two-thirds longer than the abdomen, with yellow, sparingly granulated, nervures. Habitats:—Sweden, Germany, and Switzerland.

L. pullula differs from *L. forcipata* in being much smaller, in the different shape of its abdomen, in its dark instead of yellow pygofer, and its shorter styles. Fieber says:—"Tube anal proéminent de moitié, noir, presque lamellaire vers le bas, avec deux crochets verticaux, accolés, atteignant presque avec leurs pointes incourbées et rousâtres, la demi-hauteur de la cavité du pygophore."

Size, 0·06×0·04 inch or 1·52×1·01 millimètres.

LIBURNIA PELLUCIDA, *Fab.* Plate XIV., figs. 6, 7. t. 8, fig. 20.

Delphax pellucida, Fab.; Flor; Marsh.; Fieb., G. D.
,, *marginatus* and *flavescens*, Fab.
,, *dispar*, Fall.; Kirsch.
,, *hemiptera*, Stål.
,, *saturalis*, Curt.
,, *dubia*, Kirschb.
Liburnia pellucida, Scott; Fieb., C. E. pt. iv. 3; Edw. i. 78; Ent. Mo. Mag. 1888, p. 197.

This species varies much as to colour. According to Mr. Edwards, two distinct species may be separated from some of the varieties hitherto considered to be *L. pellucida*.

The Brachypterous male and female show many shades of colour from pale brownish yellow to deep black. Scutellum more than twice longer than the pronotum. Elytra half the length of the abdomen; nervures set with fine brown bulbous granules.

Macropterous male. Head, body and abdomen all black, except that often below the scutellum an orange patch appears. Keels of the head and the scutellum grey. Second joint of the antennæ stout, and tufted with bristles. Frons black, with three unforked grey carinæ. Pygofer black, with a square, deep, semi-circular notch in the midst, from within which the anal process protrudes. Styles with obtuse, recurved, and truncated ends, spread horizontally from their bases. Elytra yellowish hyaline, one and a half times the length of the abdomen; nervures brown, with black setigerous dots. A strong beaded band runs round the apical borders. Wings transparent and colourless. Legs ochreous-yellow. (Through an error, the position of these styles — see fig. 7 — is drawn much too vertically.)

This species appears to be abundant in some localities, but it is not common on the Haslemere Hills.

	Inch.	Millimètres.
Expanse	0·32	8·12
Size	0·10×0·04	2·54×1·01

In the February number of the 'Ent. Mo. Mag.' for 1888, p. 196, Mr. Edwards revises the species of *L. pellucida* as previously described in his Synopsis of the genus. He considers that the examples usually deemed to be *pellucida* really contain three species, and that in the males the differences show themselves in the more or less cleft form of the penis and the colours of the pronotum. I possess single specimens of *L. difficilis* and *L. discreta*, both named by Mr. Edwards, and I have carefully examined the several pygofers from behind, and noted their appendages. For comparison I have drawn these insects on Plate XV., figs. 5 to 7, which may give some idea of the differences which help to separate them from *pellucida* in Mr. Edwards' judgment. From these isolated specimens I do not feel myself able to pronounce them to be other than varieties of *pellucida*. *L. discreta* is smaller and darker than *L. difficilis* of Edwards, whilst the latter has a somewhat rufous spot below the scutellum, as in *L. pellucida*. I cannot see any sufficient differences in these and the adjuncts of the pygofers to warrant the formation of two new species. On the other hand, I have not had an opportunity of seeing the cleft penis, as it was not exserted from the pygofer in either of my insects. My experience, however, does not equal that of Mr. Edwards, who doubtless possesses a sufficient series for comparison.

I append a short diagnosis of the two examples I possess, taken under a low objective power :—

Var. *difficilis*, Plate XV., fig. 5. Smaller than var. *discreta*, vertex not quite so projecting. Eyes grey. Scutellum more than two-thirds the length of the pronotum. Elytra equal to the length of the abdomen,

with a rather conspicuous orange spot below the scutellum. Legs paler than in *discreta*. Frons brown, with ochreous keels.

Var. *discreta*, Edw., Plate XV., fig. 7. Male dark umber-brown or black. Vertex projecting between the eyes, which are black. Scutellum twice the length of the pronotum, obscurely keeled. Abdomen shining black. Elytra reach to the end of the pygofer. Female much larger. Head and pronotum brown. Keels obvious. Elytra with spotted nervures. Abdomen rounded at the apex and obscurely banded with rufous. Legs brown.

The styles of both the pygofers of these insects appear to be double,—that is to say, they occur in two pairs, one above the other.

LIBURNIA DISCOLOR, *Boh.* Plate XIV., figs. 8 to 12.

Delphax discolor, Boh.; Flor; Fieb., G. D. t. 8, fig. 19.
,, *patens*, Kirschb.
Liburnia discolor, Scott; Sahlb.; Fieb., C. E. pt. iv. 3; Edw. pt. i. 79.

Macropterous male. Black; vertex and antennæ dirty ochreous. Eyes large. Frons black, with three strong yellowish undivided keels, which pass over the vertex so as to mark out five dark spots above. Pronotum with dusky centre and sides. Scutellum pointed below, and double the length of the pronotum. Abdomen umber-brown, with spots and bands black. A dusky ochreous spot occurs below the scutellum, with a round encircled spot in the midst. Legs stout and black. Elytra rather larger than the abdomen, rounded at their tips, which are bordered by a strong nervure. Veins dark brown and studded with dots. Membrane fuscous and bronzy, transversely wrinkled. Wing wanting. Pygofer large, with a deep notch within, from which a curious cruciform anal process protrudes, with long sinuous and tapering styles. Under-side dark

umber brown; segments of the abdomen ochreous; hind coxæ rufous.

The elytra of individuals differ much in length. Mr. Edwards says those of the Macropterous form are twice as long as the abdomen.

The genitalia may be compared with those of *L. discreta*, *L. difficilis*, and *L. pellucida*. As Mr. Edwards says, "A trifling alteration in the point of view will give rise to a considerable difference in the appearance of these parts." The insect therefore should be so placed as to bring into view the bases of the styles seen from behind.

Size, from 2·50 to 3·75 millimètres, or 0·09 to 0·12 inch.

Taken at Buxton, Wimbledon, Haslemere. June.

LIBURNIA DENTICAUDA, *Boh.* Plate XV., figs. 1, 2 & 15.

Delphax denticauda, Boh.; Flor; Fieb., G. D. t. 8, fig. 46.

Liburnia denticauda, Scott; Sahl.; Fieb., C. E. pt. iv. 49; Edw. pt. i. p. 81.

Colour pale yellowish. Frons yellow, with indistinct white carinæ. Abdomen black in the male, with the last segment whitish. Pronotum shorter than the vertex; keels indistinct. Elytra wrinkled, half the length of the abdomen, dirty yellow, with coarse veins and truncated apices. The middle of the pygofer shows a long sharp tooth.

The Macropterous form occurs both as male and female. The elytra of the former are one-half longer than the abdomen, whilst those of the latter are only two-thirds the length of the same. The elytral edges of my figure are too white.

The pygofer of the male, seen from above, is transverse, and notched at an acute angle. Seen from the side the border of the notch is oblique, and the border forms, by the deep "'echancrure' with the sides, a sharp angle, bent inwards" (Fieber).

I have not met with these fully-winged forms, which frequent woods and copses during the spring. The insect occurs in Switzerland, Germany, and in Livonia.

Size, from 2·00 to 2·50 millimètres, or 0·08 to 0·09 inch.

Liburnia exigua. Plate XV., figs. 3, 4.

Delphax exigua, Boh.; Flor; Kirschb.; Fieb., G. D. t. 8, fig. 43.
Liburnia exigua, Scott; Sahl.; Fieb., C. E. pt. iv. 45; Edw. pt. i. 82.

Brachypterous male. Ovate. Head, pronotum and scutellum dirty ochreous. Keels on the vertex paler than those on the prothorax, divergent. Scutellum about equal in length to the pronotum. Eyes and abdomen shining black. Pygofer with a deep sinuous notch, leaving the sides obtusely toothed. Anal parts yellow. Elytra two-thirds the length of the abdomen, ochreous, with brown nervures. Styles of pygofer ribbon-like and twisted. Legs, stout, short, and concolorous with the elytra.

Macropterous male with the scutellum three times the length of the pronotum. Elytra three times the length of the abdomen. "Alis hyalinis metallice nitentibus."—Sahlb.

Habitats: Sweden, Germany, and Switzerland. In England, at Haslemere, in Surrey, and at other places; Norfolk.

Size, 0·08×0·10 inch, or 2·00×2·50 millimètres.

Liburnia speciosa, *Boh.* Plate XV., fig. 8.

Delphax speciosa, Boheman.
Euides speciosa, Fieb., G. D. t. 8, fig. 7; Sahl.; Fieb., C. E. pt. iii. 32.
Delphax basilinea, Flor.
Dicranotropis basilinea, Kirsch.
Liburnia speciosa, Scott; Edw. pt. i. 88.

Macropterous male. Rather linear in shape ; general colour dark ochreous-yellow. Vertex square between the eyes. Pronotum brownish, with dark marks indicating the keels. Scutellum half as long again as the pronotum. Elytra long, with brown bands extending from the shoulders, along the suture, nearly to the point of the clavus. A somewhat semicircular band, broadest near the costal edge, runs with a curve towards the apex. Nervures finely granulate and brown. Two rather conspicuous dots appear at the apex of the clavus. Antennæ and legs concolorous yellow. Abdomen dark brown, with pale somatic edges. Styles short. "Viewed from behind, their apices are expanded into large rhomboidal plates."—Edw.

The Brachypterous female is very large and almost concolorous yellow. The elytra are hyaline and without brown bars.

Size 3·50 to 5·00 millimètres, or 0·14 to 0·19 inch.

Found on *Phragmites communis*.

My example is from Mr. Douglas's collection.

LIBURNIA REYI, *Fieb.* Plate XV., figs. 9 to 12.

Liburnia Reyi, Fieb., C. E. pt. iii. 23 ; Fieb., G. D. t. 8, fig. 31 ; Edw., Ent. Mon. Mag., Feb. 1888, p. 198.

Brachelytrous male. Frons projecting beyond the eyes. Colour dirty brown, with yellowish keels. Scutellum one-third longer than the pronotum. Abdomen brown, with ochreous borders. Pygofer truncated with a black anal style, and curved, pointed, and claw-like claspers. Elytra oval, and about equal in length to the abdomen, with a central brown patch and paler nervures. Legs yellowish, with dark femora. Eyes brown.

Brachelytrous female. Frons prominent and square. Eyes yellow, with a partial black pigmental spot.

Elytra short. Pygofer rounded, with a black anal style. Legs uniformly yellow.

This handsome species was taken in some quantity by Mr. Edwards, on rushes at Weybourne, Norfolk, in August. I think that he first recorded it as British. It also inhabits Germany and Mid-France.

Size, 3·0 millimètres, or 0·12 inch.

LIBURNIA FORCIPATA, *Boh.* Plate XV., figs. 13, 14.

Delphax forcipata, Boh.; Flor; Kirsch.; Fieb., G. D. t. 8, fig. 33.

Liburnia forcipata, Scott; Sahl.; Fieb., C. E. pt. iv. 26; Edw. i. 81.

Brachypterous form. General colour violet-brown, shining, oblong. Vertex brown, carinæ yellow, thus making on the crown two forward and two hinder dark spots. Eyes black. Pronotum one-third the length of the scutellum. Both of these parts are marked by yellow divergent carinæ. Elytra brown, rather blotched, and bordered with yellowish; length about half that of the abdomen. Abdomen ringed, conical, and truncated at the apex. Pygofer orange-yellow; notch deep, so as to show a trapezoidal opening, and blunt conical process. Antennæ and legs yellow. Styles of the male broad at their bases, and tapering to curved points.

Macropterous form. Scutellum relatively longer than in the Brachypterous form. "Elytra twice as long as the abdomen, fuscous, pellucid, aqueo-hyaline in female. Nervures with small setigerous granules in male."

This species inhabits woods in early spring. It is pretty generally spread over Mid-Europe.—Fieber.

Size, 2·75 to 4·00 millimètres, or 0·10 to 0·15 inch.

LIBURNIA STRIATELLA, *Fallen*. Plate XVI., fig. 1 to 1 *c*.

Delphax striatella, Fall.; Flor; Marsh.; Fieb., G. D. t. 8, fig. 21.
,, *notula*, Stål.
Liburnia striatella, Scott; Sahl.; Fieb., C. E. pt. iv. 5, 3; Edw. i. 84.

Macropterous form black. Keels of the head and fore and hind edges of the pronotum bluish grey, the dark part of the latter being spread out broadly at the margins. Scutellum black, with a reddish cross-streak; edges of the metanotum orange. Abdomen violet-black, with an orange dorsal angular spot. Elytra brownish, hyaline, iridescent, with a golden lustre. Length twice that of the abdomen, with a dark triangular spot at the extreme point of the clavus. Antennæ and legs greenish brown. Pygofer small and notched. Styles short, and dilated at their bases. (*Vide* figs. 1 *b* and 1 *c*.)

	Inch.	Millimètres.
Expanse	0·22	5·56
Size	0·08×0·03	2·02×0·76

LIBURNIA OBSCURELLA. Plate XVI., fig. 2 *a*, 2 *b*.

Delphax obscurella, Boh.; Fieb., G. D. t. 8, fig. 29.
Liburnia obscurella, Scott; Fall.; Fieb., C. E. pt. iv. 20; Edw. i. 80.

General colour pale ochreous. Eyes brown. Vertex slightly projecting, brownish. Frons dark brown, with yellow keels, the middle one forking close to the vertex. Scutellum with pale carinæ, one-third longer than the pronotum. The spots on the scutellum noted by Edwards do not always occur. Abdomen brown at the apex. Elytra one-third longer than the abdomen, pale fuscous, with a darker costal edge. Legs and antennæ concolorous with the pronotum. Pygofer seen from behind, almost an isosceles triangle with rounded

edges. Styles very short, cultriform, bent towards the inside, and marked with a black line.

Size, 3·50 millimètres, or 0·14 inch.

My figure is from Mr. J. W. Douglas's cabinet.

In colour this insect resembles *Liburnia pallida*, but their differing genitalia show them to be quite distinct species.

LIBURNIA BREVIPENNIS, *Boh.* Plate XVI., figs. 3 to 3 *a*.

Delphax brevipennis, Boh.
,, *hyalinipennis*, Stål; Fieb., G. D. t. 8, fig. 51; Kirschb.
Liburnia brevipennis, Fieb., C. E. pt. iv. 56.
,, *hyalipennis*, Sahl.; Edw. pt. i. p. 86 and pl. ii.

Almost concolorous yellow, or dirty white. Pronotum about equal in length to the scutellum, with faint carinations. Elytra very short, only three-fourths the length of the abdomen; colourless, hyaline, with delicate nervures, which are complete in number and normally disposed. Abdomen ringed. Pygofer with an arcuate notch. Styles flattish, narrow at their bases, but widened much towards their apices, which are cut square, and show within a blunt and somewhat tooth-like expansion. (See Edwards' 'Synopsis,' pt. i. Plate II., fig. 12.)

LIBURNIA FAIRMAIREI, *Perris.* Plate XVI., fig. 4.

Delphax Fairmairei, Perris.
,, *neglecta*, Flor; Fieb., G. D. t. 8, fig. 32; Marsh.
Liburnia neglecta, Scott; Fieb., C. E. pt. iv. 7.
,, *Fairmairei*, Edw. i. 85, pt. ii. fig. 10.

Brachypterous form pale yellow, oval. Vertex with three keels projecting beyond the eyes. Pronotum and

scutellum black, the former with a triangular, and the latter with a trapezoidal, yellow spot. Abdomen yellow, with reddish outer edges to the somites. Dorsal yellow spots and black markings are seen on the abdomen. Pygofer deeply notched, ochreous, with a yellow style. Elytra grey, with dark nervures and an inner whitish border; length hardly more than half that of the abdomen. Legs and antennæ ochreous.

The male styles, according to Fieber and Edwards, are without the projecting inner teeth, as seen in *L. brevipennis*. This insect is very variable in colour, some appearing even black. The males are not often met with, and then only in early autumn, at which time they consort with the females.

Mr. Edwards states that *Achrotyle bivittata* of Fieber is only the pupal condition of *L. Fairmairei* or some form of one of the nymphal Delphacidæ; and that the tubercles to be commonly seen on such disappear when the insects come to the adult state (*vide* Ent. Mo. Mag., vol. xxii., p. 67). The same author states that "amongst hundreds of nymphs of Delphacidæ he has examined, not one has occurred which does not present the Achrotyle face." Amongst species particularly noted as tuberculated, he instances *Liburnia forcipata*, *L. unicolor*, and *Stiroma pteridis* (see my Plate XXI., figs. 2 and 2 *a*.

LIBURNIA DOUGLASI, *Scott*. Plate XVI., figs. 5 to 5 *c*.

Liburnia Douglasi, Fieb., C. E. pt. iv. 30, 27.

Very small. General colour yellow. Vertex rounded in front, with a yellow line dividing the vertex from the eyes, and another connecting these lines. Frons and clypeus black. Pronotum with four fairly distinct yellowish keels. Elytra brown, with paler veinings, and rather more than half the length of the abdomen. Abdomen brown, and barred with yellow. Truncated at the apex. Pygofer of the male yellow, with a shal-

low semicircular notch, a small black pointed anal process, and two sickle-shaped styles.

My figure is from a specimen kindly lent by Mr. Douglas, and taken at the roots of rushes in Folkestone Warren.

Size, 2·00 millimètres, or 0·08 inch.

The Brachypterous female is larger than the male, and it has very similar colouring and markings, though less pronounced. The notch of the pygofer is narrower, and when viewed from above the anal tube and style are more obvious (*vide* figs. 5 *b* and 5 *c*). As this example, lent by Mr. Douglas, was gummed on a card, no examination was possible as to the form of the lateral valves and the saw-case.

The Brachypterous female has not been circumstantially drawn or noted before.

Liburnia mesomela, *Boh.* Plate XVII., figs. 1, 1 *a*, and Plate XVIII., fig. 3.

Delphax mesomelas, Boh.; Flor; Kirschb.
Delphacinus mesomelas, Fieb., G. D. t. 8, fig. 12, C. E. pt. iii. 25; Sahl.
Liburnia mesomela, Scott; Edw. pt. i. 91.

Brachelytrous male. Form short and stout. Head, antennæ, pronotum, frons and scutellum honey-yellow; the two latter parts almost spotless. Eyes large and greyish. Elytra short, rounded, yellow, each with a crescentic mark near its apex, producing thus a pale border. Length less than half that of the abdomen. Some specimens have almost white elytra, and perhaps their colour in general is lighter than that shown in my figure—one out of seventeen. Abdomen black, with a large blunt pygofer. Pygofer quadrangular, cleft into two plates, containing black styles. The pygofer is separated from the body-rings by one or two white lines or edgings. Legs short and stout, particularly

the hinder ones ; colour black. Clypeus and rostrum black. Plate XVIII., fig. 3.

The Brachypterous female is longer and thinner than the male, with brown eyes. The rest of the insect is dirty yellow. Apex of the abdomen pointed.

I have not met with the Macropterous male ; but Fieber describes it as having, in both sexes, elytra long and livid-white, bordered with yellow, and arched with brown up to the inferior part of the commissure.

The form of the vertex in my figure is less pointed than that given in Fieber's outline. The contour of the pygofer is a long lozenge, but seen from above it is quadrangular.

Taken on wet herbage. Habitats : Sweden, Germany, France, and England. Found in Norfolk, Haslemere, Sheire near Guildford, and other places.

Size, with elytra, 2·00 to 3·75 millimètres, or 0·09 to 0·14 inch.

This insect shows some resemblance to *L. exigua*, but the legs of the latter are yellow, and the pronotal keels are more pronounced.

LIBURNIA AUBEI, *Perris*. Plate XVII., figs. 2, 2 *a*.

Delphax Aubei, Perris.
,, *cognatus*, Fieb., G. D. t. 8, fig. 42.
,, *obsoletus*, Kirschb. ; Sahl.
Liburnia cognatus, Scott ; Fieb., C. E. pt. iv, 45.
,, *Aubei*, Edw. i. 84.

Brachypterous male long. Head, pronotum, and scutellum yellow. Elytra yellowish, rounded, with a crescentic mark as in the preceding species. Central and side keels carried to the base of the scutellum. Abdomen fusiform, ochreous-yellow, with five interrupted black bands, cutting the dorsal region into irregular streaks with a pale dorsal longitudinal line.

Pygofer deeply notched, and moderate in size. Styles (fig. 2 *a*) flat, sinuous, and recurved.

Brachypterous female with a greyish streak down the dorsum, and with colouring very like the male.

My specimens were from Mr. Edwards' cabinet, who records that the species is common on sandy coasts.

Size, from 2·50 to 3·00 millimètres, or 0·09 to 0·12 inch.

Liburnia limbata. Plate XVII., figs. 3 to 3 *d*.

Delphax limbata, Fab.; Boh.; Flor; Marsh.; Kirsch.
,, *signifera*, Boh.
,, *paliata*, Boh.
,, *anceps*, Germ.; Schäff.
,, *pictipennis*, Curt. pl. 657, 7.
Conomelus limbatus, Fieb., G. D. t. 8, fig. 10, and C. E. pt. iii. 39.
Liburnia limbata, Sahl.; Scott; Edw. i. 89.

Brachelytrous male. Form oval. Head and eyes greyish; antennæ ochreous. Vertex nearly flat, with three dark marks showing the position of the keels, which are carried through, and diverge on the yellow pronotum to the posterior edge. Scutellum long and grey. Abdomen carinated on the dorsum, and well marked into somites. Colour brown, with yellow or ochreous spots down each side, and irregularly marked yellow dots on the dorsum. Pygofer seen from above small, and tri-partite. Elytra milky-grey, and not half the length of the abdomen. Principal nervures punctured with oblong brown dots. Legs brown.

Brachelytrous female uniformly ochreous-brown, with darker brown vertical streaks on the head and thorax. Abdomen longer than seen in the male. Elytra smaller and similarly spotted. Wings absent.

Macropterous male. This prettily variegated insect is rarely met with. Head and pronotum ochreous-brown, and streaked as before described. Scutellum

longer than the pronotum. Abdomen dark brown. Elytra nearly twice the length of the abdomen, milky-grey stained with yellowish, particularly so in the neighbourhood of the claval suture. Radial and apical veins markedly spotted. An irregular spot appears at the point of each clavus, and a large rough-edged black band, proceeding from the costa, sweeps downwards and ends at the apical margin.

The pupæ of the genus *Liburnia* are not often met with. At first there might seem to be a question whether some of these Brachelytrous forms are not nymphs. They might be looked on as pupal forms which are arrested in their development into imagoes. But on the contrary, it is certain that they have no elytral cases, and their elytra (such as they have) are free to move. Moreover, they have a true neuration, although in a stunted form.

The fact that they show a complete development of sex also precludes the idea of their being only simple pupæ.

The neuration of the aliary apparatus in *L. limbata* (fig. 3 *d*) furnishes a good general example of the structure of these organs in the genus. It may be seen that the punctuation does not extend to all the nervures of the elytra, and that the wings are quite free from these markings.

Under-side rich brown, with brown clypeus. Legs mottled with ochreous and finely pubescent. Back view of the pygofer tectiform, with strong styles also pubescent.

Common throughout all Europe. Plentiful in the Guildford district, and at Haslemere, on dank grass and rushes.

	Inch.	Millimètres.
Expanse	0·30	0·79
Body	0·09	2·50

LIBURNIA LINEATA, *Perris*. Plate XVII., figs. 4 to 4 *a*.

Delphax lineata, Perris.
,, *quadravittata*, Kirschb.
Eurysa vittata, Fieb., G. D. t. 8, fig. 9, and C. E. pt. iii. 36.
Liburnia lineata, Scott; Edw. pt. i. 90.

Brachypterous male small. General colour ochreous. Frons black. Vertex with two brown spots. Pronotum with four well-marked brown longitudinal stripes. Elytra about half the length of the abdomen, pale ochreous, with faint brownish stains. Abdomen ringed, with one dorsal and two lateral brown stripes converging to the tail. Pygofer bifid; seen sideways it has somewhat the profile of a bird's head and neck. Legs yellowish.

Brachelytrous female has much the same colouring as the male. Frons brown. Abdomen pointed and marked with stripes, less pronounced in the male.

The Macropterous form of this Delphacid has not come under my observation.

Size, 2·50 to 4·00 millimètres, or 0·09 to 0·15 inch.

LIBURNIA FLAVIOLA, *Flor*. Plate XVIII., figs. 1 to 1 *b*.

Delphax flaveola, Flor; Kirschb.; Fieb., G. D. t. 8, fig. 55.
Liburnia flaviola, Sahl.; Fieb., C. E. pt. 61; Scott; Edw. pt. i. 87.

Macropterous female. Vertex square. General colour fulvous-yellow. Elytra pale yellow and transparent. Abdomen brownish yellow, about equal to the elytra in length. Legs yellow, with brown spots and stripes on the hind tibiæ and femora. Two spots generally occur at the base of the vertex. The anal process or cauda projects beyond the pygofer. Fig. 1 is from Mr. Douglas's collection.

Macropterous male. Upper side uniformly warm sienna-yellow. Vertex yellow and slightly produced, with two brown spots on the crown. Frons brown, with yellow keels, the central carina forked just before the vertex. Pronotum short, pale yellow, with the lower margin arcuate. Scutellum reddish, one and a half times longer than the pronotum, with the keels and lower sinuous edge well marked. Abdomen brown, with pale lateral edges and somatic margins. Elytra hyaline, one-half longer than the abdomen. Venation fine and brownish. Membrane yellow, clouded with brown at the apices, and dashed with fuscous-yellow at their bases. Small tegulæ occur at the elytral insertions. Wings delicate and pale grey. Legs and antennæ clay-yellow. Knees and tibiæ with dots and longitudinal brown stripes. Hind femora brown. Under side umber-brown, and variegated with darker brown blotches. Pygofer obtuse, with sinuous edges. Styles lanceolate, with tips obliquely truncate.

The Brachelytrous female nearly resembles that of the next species described. Fieber describes the male as having pale nervures, finely spotted with yellow; tarsal joints black. Pygofer oval, or shaped like a lozenge with round sides. Styles dilated at their bases, recurved, and truncate at their ends. Their forms are very similar to those figured for *L. pellucida* in my Plate XIV., fig. 7.

N.B.—The neuration in my figure is printed too coarsely for accuracy, and the colour is too heavy.

LIBURNIA STRAMINEA, *Stål.* Plate XVIII., figs. 2, 2*a*, 2*b*.

Delphax straminea, Stål; Fieb., G. D. t. 8, fig. 54.
Liburnia straminea, Sahl.; Fieb., C. E. pt. iv. 60; Edw. pt. i. 86.
Liburnia v-flava, Scott.

Brachelytrous male. General colour pale yellow. Eyes brown. Pronotum with two faint brown spots. Scutellum nearly twice the length of the pronotum. Elytra half the length of the abdomen. Nervures pale brown and punctured. Abdomen yellow and somewhat ridged. Styles usually carried horizontally (Edwards). Pygofer, viewed from behind, short-oval. Opening thickened at the base. The lanceolate or strap-shaped penis (?) is supported by two strong curved styles, the points of which appear at the opening of the pygofer. Above these, two blunt tooth-like processes are attached to the anal tube, and thus point downwards. The anal tube is round at the mouth, and contains the usual Cauda or anal-style, which is conical in form.

Perhaps it will be well always to call this process the Cauda to avoid confusion, for it obviously functions the same as the cauda in *Aphis*. It has its presence in almost every genus of that Family. The organ, whatever its use may be, is identically significant in in *Cicadina* and *Aphis*.

The genitalia of *Liburnia straminea* and *L. Reyi* are remarkable for their specialization; and their details are very complex. Attempts to explain how these different apparatus subserve the design in view, probably at present would amount to little more than guess-work, yet we may see, in the case of *L. straminea*, that special muscles act on the styles so as to compress them, much in the same manner as seen in a pair of sheep-shears. (*Vide* fig. 2*b*.)

I have no specimens of *Liburnia boldi*, *L. perspicillata*, *L. melanopachys*, *L. insignis*, nor of *L. Dalei*. Of the first, *L. boldi*, Scott seems to have seen only the female. Mr. Edwards, however, dissected out the styles of the male, from which I afterwards made for him drawings. Mr. James Hardy took one example of *L. perspicillata* on the Cheviot Hills in the month of October. I do not know that others have been since recorded as British.

PLATE XI.

Liburnia smaragdula. (Page 34.)

Fig. 1.—Macropterous winged male, with its broad anal plates. The ramifications of the elytral nervures may be compared with those of *L. scutellata*, Plate XIII. (N.B.—The yellow markings on the abdomen are too pronounced in my figure. The fine green colour of the living insect soon fades in cabinet specimens.)

Fig. 2.—Brachelytrous female of the same. It is much larger than the male, and it has almost obsolete elytra.

Fig. 3.—Head, pronotum, and scutellum of the imago.

Fig. 4.—Part of the hind tarsus and the tibial spurs.

Liburnia unicolor. (Page 35.)

Fig. 5.—Macropterous male showing the projecting vertex. When at rest the hind legs are often crossed so as to show only the tarsi.

Liburnia collina. (Page 35.)

Fig. 6.—Macropterous male, which is almost uniformly ochreous yellow.

Fig. 7.—Brachypterous female, drawn of relative size to the preceding figure.

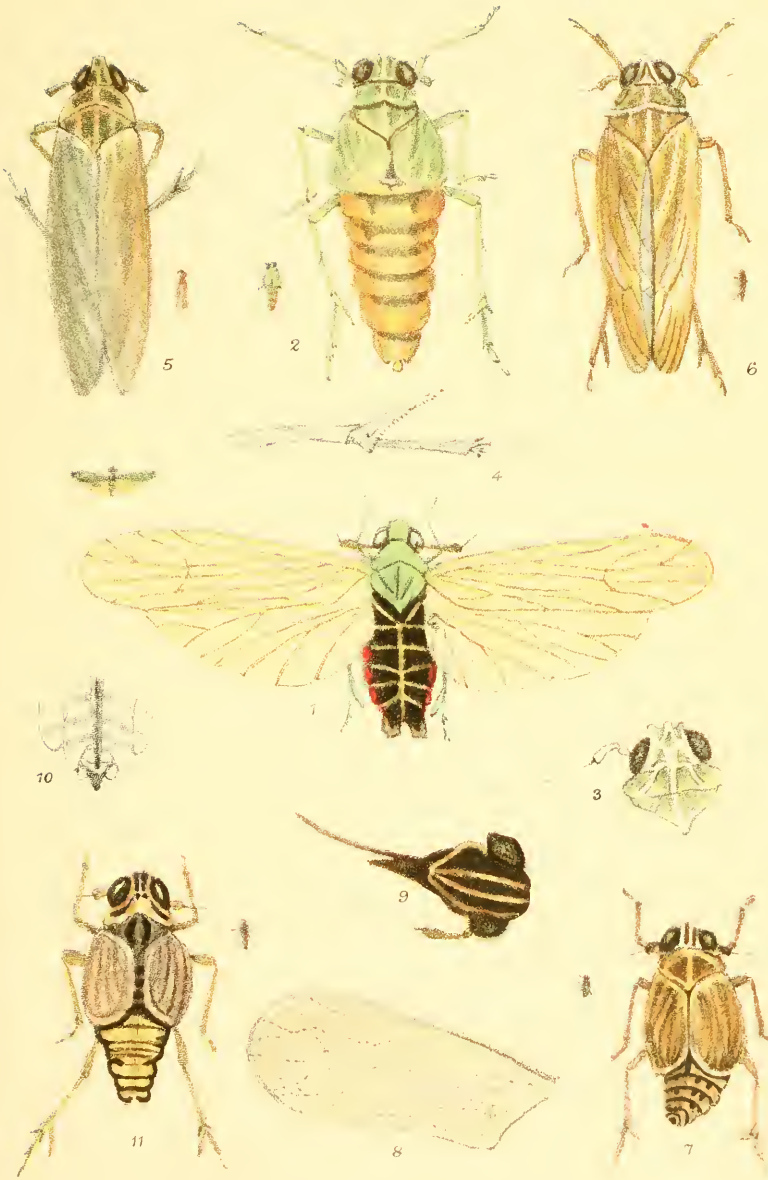
Fig. 8.—Short elytron, with its dotted nervures.

Fig. 9.—Frontal view of the head, with its central undivided keel.

Fig. 10.—Under side of the last abdominal segments of the female, with its saw-case and anal process.

Liburnia elegantula. (Page 36.)

Fig. 11—Brachelytrous male. In some specimens the scutella are nearly black.



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West Newman chromo.

PLATE XII.

Liburnia lepida. (Page 37.)

Fig. 1.—Macropterous form, with its milk-white spotted elytra, and the frontal keels prolonged to the posterior edge of the scutellum. The legs are ringed.

Fig. 2.—Female of the relative size.

Fig. 3.—Brachelytrous male, with its truncated pygofer. These forms are not pupal for the degraded elytra are free.

Fig. 4.—Head and pronotum of fig. 1.

Liburnia guttula. (Page 38.)

Fig. 5.—Macropterous male, with its enlarged pygofer and anal processes. Some examples show the dark streak carried to the base of the elytron.

Fig. 6.—Elytron of the same, the membrane of which is almost transparent.

Fig. 7.—Anal style, with two filiform adjuncts protruding from the tubular process.

Fig. 8.—The entire pygofer of the male, viewed from above. This complex organ shows two lateral plates, two pincer-like styles, and the curved penis, with its bristles emerging from the spatulose sheath, (pygothèque).

Liburnia adela. (Page 39.)

Fig. 9.—Macropterous male, with its punctate elytra.

Fig. 10.—Frons of the same, showing the middle keel forked just below the vertex.

Fig. 11.—Elytron, showing the strengthened apical border and the punctate nervures. Compare *L. capnodes*, Plate XIII.

LIBURNIA FIEBERI. (Page 39.)

Fig. 12.—Brachelytrous female. Some specimens are darker than that figured, and they have a palish border round the elytra. The smaller male has some resemblance to *L. leptosoma*.

LIBURNIA SIGNORETI. (Page 40)

Fig. 13.—Obese form of the brachelytrous female, with the characteristic pointed anal plates. The pronotum and scutellum, in this case, almost merge into one. The insect figured was probably distended with eggs.

LIBURNIA VENOSA. (Page 41.)

Fig. 14.—Brachelytrous female, with broad rounded anal plates, and the elytra bordered with white. The usual outer tibial spurs are here obvious, and also the tarsi crowned with spines.

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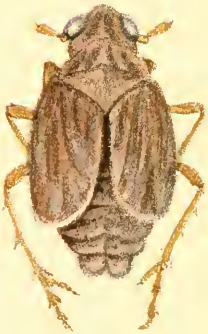
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PLATE XIII.

Liburnia capnodes. (Page 41.)

Fig. 1.—Brachypterous female, showing the rudimentary wings and obliquely rounded pygofer.

Fig. 2.—Head, pronotum, and scutellum of the male, with its faintly marked keels. The pronotum, by pressure of the head downwards, shows itself as a kind of hood, and that it overlaps the scutellum below.

Fig. 3.—Elytron and wing of the male. Part of the costa and the apical periphery is thickened, and the band is seen marked by strong striations. The minor thickening of the wing by error has been omitted in my figure.

Fig. 4.—Hind tarsus and claw much enlarged.

Fig. 5.—Frons, clypeus, proboscis, and antennæ of the male. The basal joint is annulose.

Fig. 6.—Part of the peripheral band of an elytron, with the nervures bearing setigerous hairs.

Liburnia pallidula. (Page 42.)

Fig. 7.—Macropterous female, with folded elytra.

Fig. 8.—Male insect, showing the rudimentary wings below the spread elytra.

Fig. 9.—Pygofer of the female with its anal tube.

Fig. 10.—Pygofer of the male, with its anal tube, setæ, lateral plates, and spatulose sheath. The singular bristles of the penis are worthy of note. A somewhat similar apparatus may be seen on Plate XII., fig. 8.

Liburnia scutellata. (Page 44.)

Fig. 11.—Macropterous male.

Fig. 12.—Elytron with wing of the same.

Liburnia leptosoma. (Page 44.)

Fig. 13.—Brachypterous form, with its tridentate abdominal apex and its white bordered elytra.

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West, Newman chromo

PLATE XIV.

LIBURNIA LUGUBRINA. (Page 45.)

Fig. 1.—Brachelytrous female, with its white-edged elytra.

Fig. 2.—Anal tube seen from behind, with the male styles below, *s*, spreading from the lower edge of the pygofer.

LIBURNIA DISTINCTA. (Page 46.)

Fig. 3.—Brachelytrous female, from Mr. Douglas's cabinet.

LIBURNIA PULLULA. (Page 47.)

Fig. 4.—Brachelytrous male, with its attenuated body.

Fig. 5.—Pygofer, with the styles, *s*, seen from behind.

LIBURNIA PELLUCIDA. (Page 48.)

Fig. 6.—Macropterous male, showing the deep notch in the pygofer. The nervures do not strictly accord, side with side. (See also Plate XV.)

Fig. 7.—Styles from the male pygofer.

LIBURNIA DISCOLOR. (Page 50.)

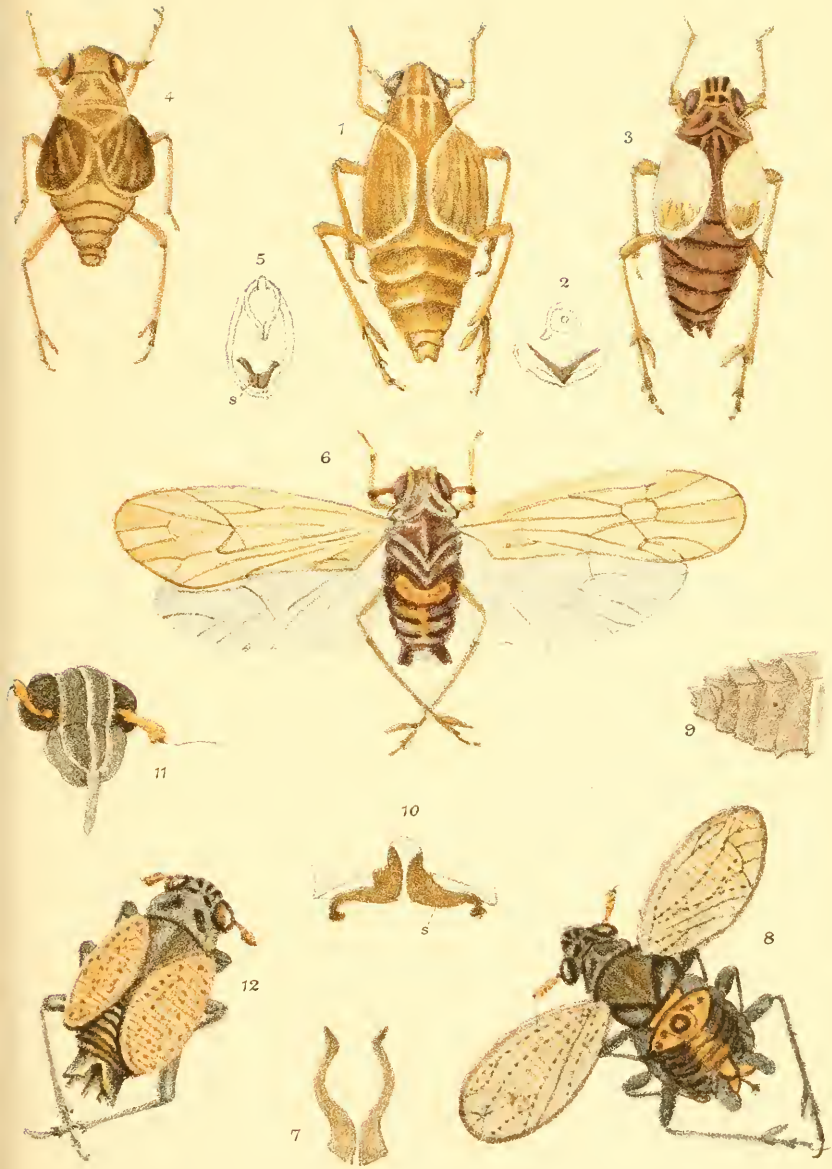
Fig. 8.—Brachelytrous (?) male. The wings are wanting. The peculiar form of the pygofer, with its adjuncts, may be noted.

Fig. 9.—Last abdominal ring of the female.

Fig. 10.—End of the male pygofer seen from above, with its curved styles, *s*, in situ.

Fig. 11.—Frons and clypeus of the same, showing the three undivided keels, and the position of the antennæ.

Fig. 12.—Another brachelytrous male, with its elytra closed. The pygofer is here deeply notched.



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West, Newman chromo

PLATE XV.

Liburnia denticauda. (Page 51.)

Fig. 1.—Brachypterous female.
Fig. 2.—Frons, with its almost obsolete keels. (For style of male, see fig. 15.)

Liburnia exigua. (Page 52.)

Fig. 3.—Brachelytrous male, showing its short and stout legs, and notched pygofer.
Fig. 4.—Styles and part of the pygofer of the same insect.

Liburnia pellucida. (Page 48.)

Fig. 5.—Brachelytrous form, var. *difficilis* of Edwards.
Fig. 6.—Brachelytrous form, var. *discreta* of Edwards. (See also Plate XIV., fig. 6.)
Fig. 7.—Brachelytrous male of the same.

Liburnia speciosa. (Page 52.)

Fig. 8.—Macropterous male, from Mr. Douglas's cabinet.

Liburnia Reyi. (Page 53.)

Fig. 9.—Brachelytrous male, with truncated abdomen.
Fig. 10.—Brachelytrous female, with pointed abdomen.
Fig. 11.—Side view of anal process, styles, and penis of the male dissected out.
Fig. 12.—Head, pronotum, and frons of the same insect. (See Plate XVIII., fig. 5.)

Liburnia forcipata. (Page 54.)

Fig. 13.—Brachelytrous male with its notched pygofer.
Fig. 14.—One of the male styles, attenuated at the tip.

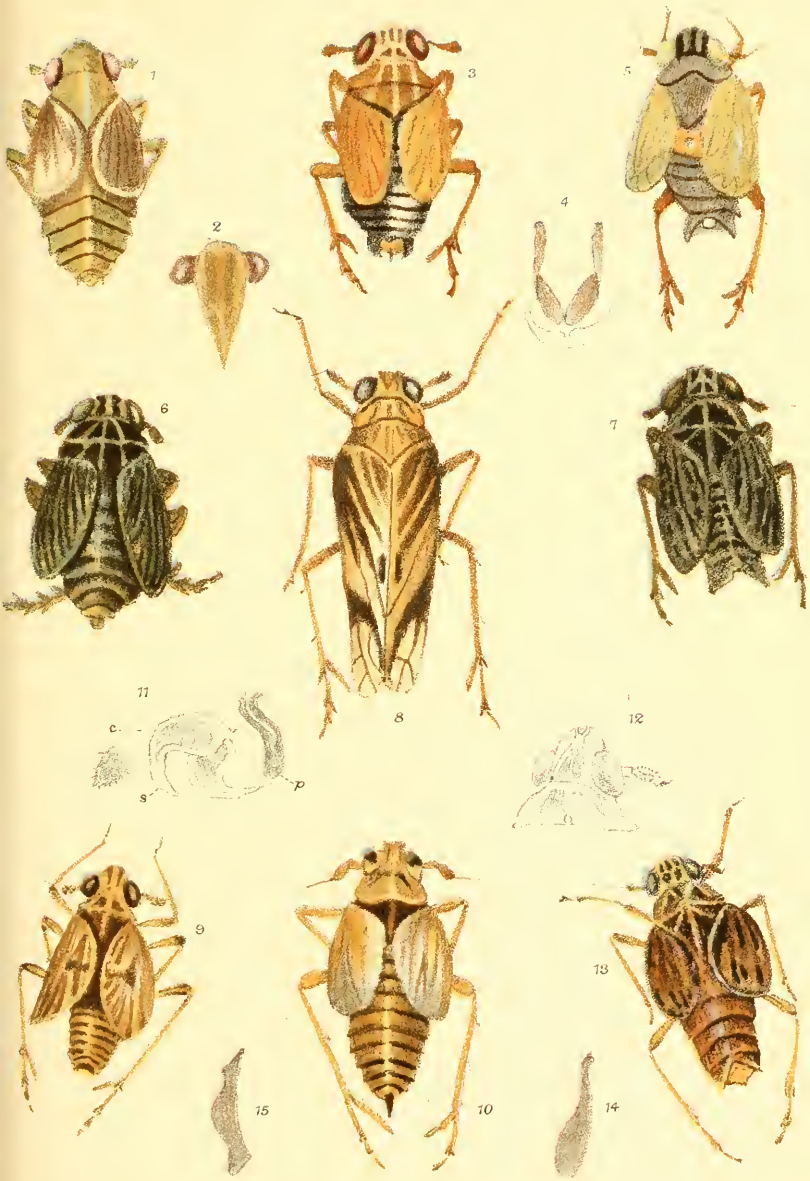

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PLATE XVI.

LIBURNIA STRIATELLA. (Page 55.)

Fig. 1.—Brachypterous wingless female.
Fig. 1*a*.—Macropterous form.

LIBURNIA OBSCURELLA. (Page 55.)

Fig. 2.—Macropterous female.
Fig. 2*a*.—Head, pronotum, and antennæ of the same.
Fig. 2*b*.—Frons, showing the keels, clypeus, and rostrum.

LIBURNIA BREVIPENNIS. (Page 56.)

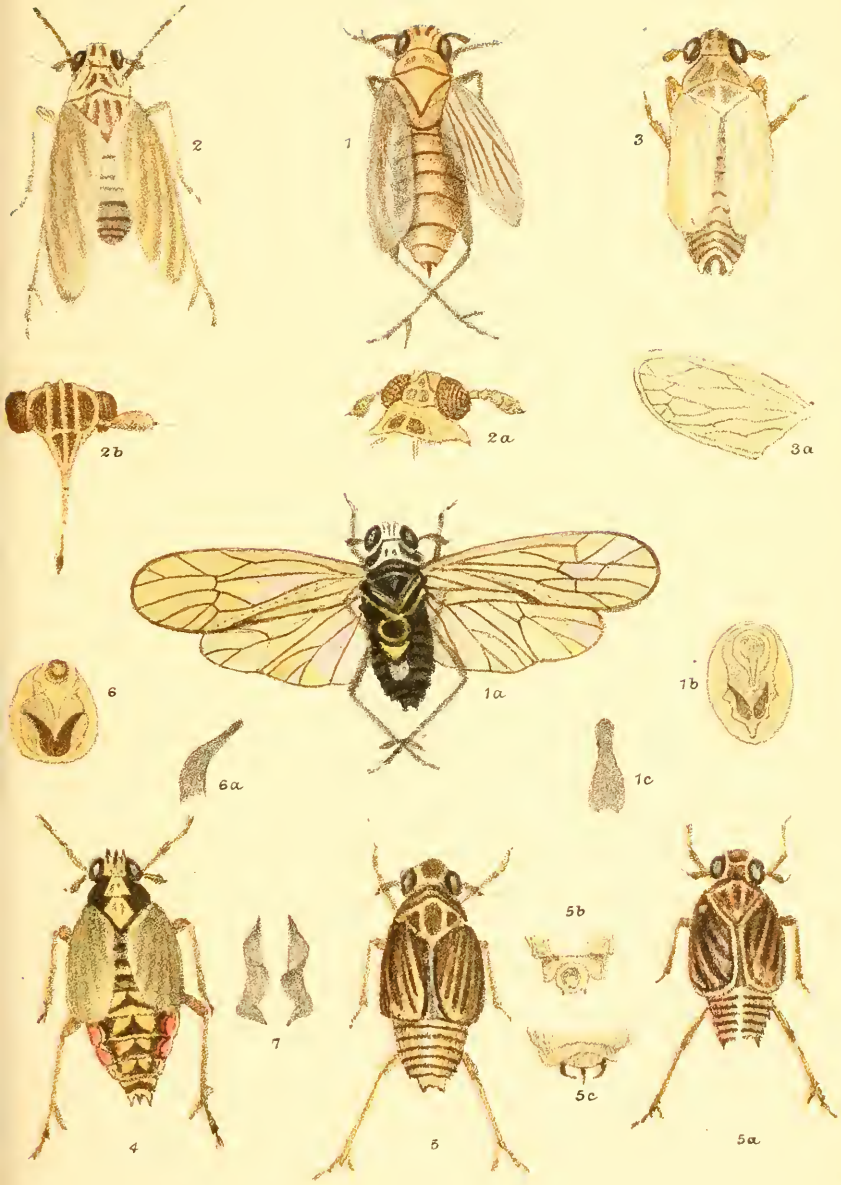
Fig. 3.—Brachelytrous form.
Fig 3*a*.—Elytron, showing the simple venation.

LIBURNIA FAIRMAIREI. (Page 56.)

Fig. 4.—Brachelytrous form. (See also Plate XXI., fig. 2.)

LIBURNIA DOUGLASI. (Page 57.)

Fig. 5.—Brachelytrous female, showing a narrow pygofer.
Fig. 5*a*.—Brachelytrous male, with a widened pygofer.
Fig. 5*b*.—Pygofer of female, viewed from above.
Fig. 5*c*.—Pygofer of male, from the same point of view.
Fig. 6.—Pygofer of *Liburnia leptosoma*. (*Vide* Plate XIII., fig. 13.)
Fig. 7.—Pygofer of *Liburnia Boldi*. After Edwards.



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West, Newman chromo

PLATE XVII.

Liburnia mesomela. (Page 58.)

Fig. 1.—Brachelytrous male. The large and squarish pygofer of this species may be compared with that of *L. discolor*, *L. exigua*, and *L. pellucida*.

Fig. 1*a*.—Brachelytrous female. *Vide* Plate XVIII., fig. 3, for frons and rostrum.

Liburnia Aubei. (Page 59.)

Fig. 2. — Brachelytrous male, with deep notched pygofer.

Fig. 2*a*.—Isolated male styles of the same.

Liburnia limbata. (Page 60.)

Fig. 3.—Brachelytrous female. Two scarlet-coloured Acari are attached to the hind tibiæ. Some notice of these Trombidia will be added to other observations on some parasites infesting British Tettigidæ.

Fig. 3*a*.—Macropterous male.

Fig. 3*b*.—Brachelytrous male. Abdomen bordered with orange.

Fig. 3*c*.—Antenna of the male, much magnified.

Fig. 3*d*. — Elytron and wing of the male. The simple character of the neuration may be noted.

Liburnia lineata. (Page 62.)

Fig. 4.—Brachelytrous female.

Fig. 4*a*.—Brachelytrous male. The brown longitudinal markings are distinctive.

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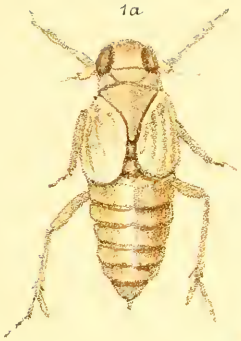
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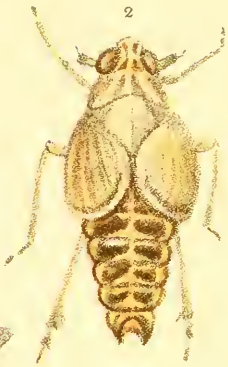
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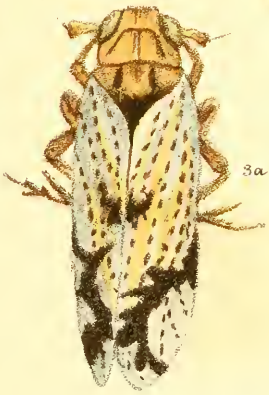
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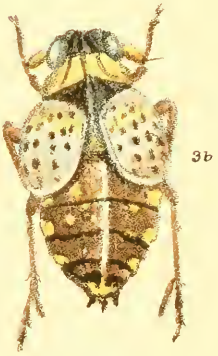
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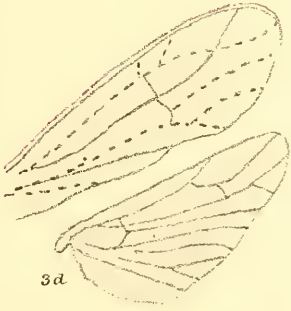
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PLATE XVIII.

LIBURNIA FLAVEOLA. (Page 62.)

Fig. 1.—Brachelytrous female, showing its broad vertex.

Fig. 1*a*.—Macropterous male. The natural insects are fulvous-yellow in colour. By mistake the tints of the figures in this plate are too heavy.

Fig. 1*b*.—Head, vertex, frons, and antennæ of the same.

LIBURNIA STRAMINEA. (Page 63.)

Fig. 2.—Brachelytrous female.

Fig. 2*a*. — Pygofer of the male seen from behind, showing the conical cauda within the anal ring. Below this two horny prehensile teeth are attached, and at the base of the opening the ends of the styles appear. The lanceolate summit of the penis appears above and between these styles.

Fig. 2 *b*.—The end of the male pygofer seen from below, the parts having been bleached and made transparent by a watery solution of potassic chlorate, mixed with a little hydrochloric acid. The shear-like styles are seen to have, at *g g*, extensor and flexor muscles to separate or to keep them together. Between these styles the penis is seen, and on the upper edge of the opening two pad-like organs are attached. They are circularly ciliated on their under sides.

Fig. 3.—Under side of the head and pronotum of *L. mesomela*, showing the peculiar form of the brown clypeus and the rostrum. The setæ are seen to project beyond the sheath of the proboscis.

Fig. 4.—Genitalia of *L Aubei*, same parts as above. The male style is enlarged and drawn at the side.

Fig. 5. — End of the female pygofer of *L. Reyi*, much enlarged, and viewed in profile. *c*. The cauda. Two strong and sharp hooks at *s*, point downwards, and appear to be opposed to the comparatively small saw and its appendages below (part of the sheath). A double ligament (*l*) is attached to the edge of the somite. The cauda and the hooks are capable of retraction within the anal ring, which last is seen in perspective. Bleached in acid.

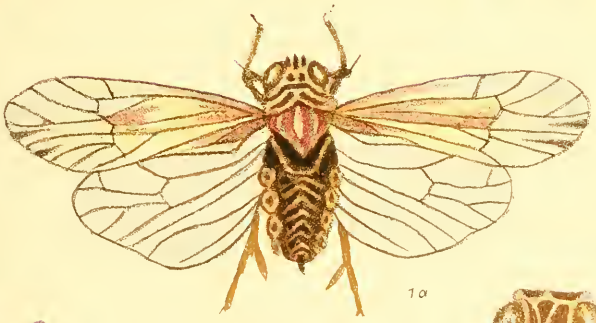
Fig. 6.—Antenna of *Liburnia Reyi* much enlarged. The two basal joints are cylindrical. The setiform termination springs from a bulb (*t*). The second joint, like that of many other Delphacids, is furnished with fossæ or pits (*f*), each of which has a fine membrane stretched over the mouth. These doubtless act in the same manner as I have before shown they do in the antennæ of some Aphides. Probably these membranes are in connection with the nerve fibres within, and vibrate to external sounds.

See 'Monograph of British Aphides,' Ray Society.

1

3

2



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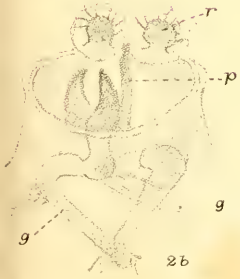

2b

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PLATE XIX.

Dicranotropis hamata. (Page 66.)

Fig. 1.—Macropterous male, showing the four white keels on the vertex.

Fig. 1 *a*.—Brachelytrous female.

Fig. 1 *b*.—Frons and clypeus of the male. The central keel furcates about half-way between the suture of the clypeus and the vertex.

Fig. 1 *c*.—Dorsal view of the pygofer of the female insect. *e*. The usual cauda. *h*. Cornua flanking the opening of the pygofer.

Stiroma nigrolineata. (Page 71.)

Fig. 2.—Macropterous female.

Fig. 2 *a*.—Brachelytrous female, which is larger in body than the male.

Fig. 2 *b*.—Brachelytrous male, seen in profile.

Fig. 2 *c*.—Pygofer of the male. *r*. Supplemental teeth below the anal tube. *p*. The penis. *s*. One of the styles.

Stiroma affinis. (Page 70.)

Fig. 3.—Brachelytrous female, the body of which is one-third larger than the male. The latter is usually darker on the abdomen.

1
1a
1b
2d
2
♂
♀
e
h
p
s
2c
1c
3
2b
2a

PLATE XX.

Stiroma albomarginata. (Page 68.)

Fig. 1.—Brachelytrous male.

Fig. 1 *a*.—Brachelytrous female.

Fig. 1 *b*.—Frons, showing the position of the forking of the middle keel or carina.

Fig. 1 *c*.—Profile of the head, showing the insertion of the antenna.

Fig. 1 *d*.—Pygofer of the same insect, showing the anal tube and styles.

Fig. 1 *e*.—Part of the under side of the female, showing, at *s*, the saw, disengaged from its groove between the large valves below.

Fig. 2.—Larval form? (*Achrotile albosignata* of Fieber?) For details see Plate XXI., figs. 2 and 2 *a*.

Stiroma pteridis. (Page 71.)

Fig. 3.—Brachelytrous male.

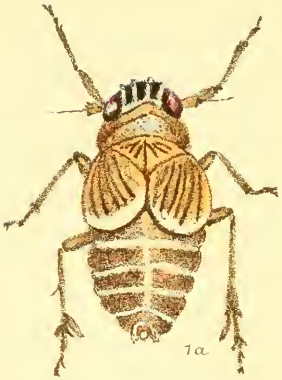
Fig. 3 *a*.—Brachelytrous female.

Fig. 3 *b*.—Frons and antennæ of the female.

Fig. 3 *c*.—End of the male pygofer, with its styles and other details. *x*. The black cauda. Both this figure and fig. 1 *d* are drawn inverted, and thus they differ in position from the other figures of pygofers.

1

x 1d.



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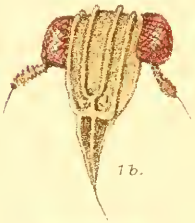
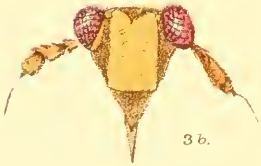


1b.

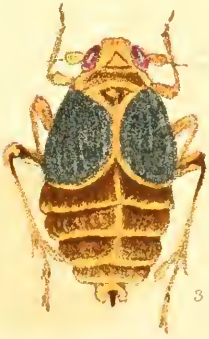
3 1e.



3b.

3a.

x 3c.



3

MONOGRAPH

OF THE

BRITISH CICADÆ

(Froghoppers and Grassflies).

By GEORGE BOWDLER BUCKTON, F.R.S., &c.

The comparison of specimen with specimen is the basis of all zoological and biological research. Doubtless, after living forms, collation with museum specimens is of the greatest use to the investigator. Such specimens, however, are not open to the use of many, and to those who have no access to them, monographs are of prime importance.

It will be admitted that every enlightened and civilised country ought to concern itself with the description of its Fauna and Flora. Quite apart from an economic point of view, it is incumbent on us to help forward the progress of knowledge, and to accumulate materials for comparing present living forms with those varieties which may proceed from them in future years; and these materials will assist in the elucidation of some of the far-reaching developmental problems under discussion at the present time.

No coloured monograph of the British Cicadæ exists, and it is even believed that no adequately illustrated monograph exists of European species. Partly to meet this want, it is proposed to publish eight quarterly Parts, each containing on an average ten litho-chromo plates and letterpress, illustrating the forms, metamorphoses, general anatomy, and the chief details connected with the life-history of this family of insects.

The work will contain also short diagnoses of all the British species, about 230 in number, most of which have come under the author's notice, each species being illustrated by one or more coloured drawings. Some account will be given of the curious myths and tales told by ancient Greek and Latin poets, and descriptions will be appended relating to the curious sound-organs possessed by some species, and other subjects connected with the economy of this interesting but difficult group of Rhynchotous insects.

It is believed that by the help of the numerous camera-lucida drawings, which will appear in this Monograph, many of which have been made from type specimens in the cabinets of Mr. J. W. Douglas and Mr. James Edwards, the identification of nearly-allied species will be facilitated.

July, 1890.] [In Eight Parts.—Part III.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,

MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

London

MACMILLAN AND CO.

AND NEW YORK

1890

Price Eight Shillings

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ABBREVIATED TITLES OF THE WORKS OF AUTHORS QUOTED IN SYNONYMS OF SPECIES.

Am. et Ser. ... Amyot et Serville. Histoire naturelle des Insectes; Hemiptères. Paris, 1843.

Boh. ..... Boheman. Nya Svenska Homoptera, i Kongl. Vetenskaps-Akademiens Handlingar, 1845. Stockholm, 1847.

Burm. ..... Burmeister. Handbuch der Entomologie, Band. II. Berlin, 1835.

DeGeer ..... DeGeer. Abhandlungen zur Geschichte der Insecten. 1780.

Doug. ..... Douglas, J. W. *Vide* numerous notices on Cicadinæ in Ent. Mo. Mag. from 1876 to 1889.

Doug. & Scott. . Douglas and Scott. Cat. Brit. Hemip. Ent. Soc. of Lond. 1876.

Edw. ..... Edwards, James. Homoptera-Cicadina, Trans. Ent. Soc. Lond., Part II. 1886.

Fab. ..... Fabricius. Entomologia Systematica, Tom. iv. 1794.

Fall. ..... Fallén. Acta Holmensia för 1805 och 1806. Hemiptera Sveciæ. 1829.

Fieb., C. E. ... Fieber, Franz Zavier. Les Cicadines d'Europe; Travaux inedits; Tràduit par M. Ferd, Reiber. Revue et Mag. de Zoologie. 1875.

,, *S. T.* ... Fieber. Synopse d. Arten Tettigometra. 1865.

,, *G. D.* ... Fieber. Grundzüge z. generischen Theilung d. Delphacini. Vienne, 1866. Plates.

,, *S. D.* ... Fieber. Synopse Deltocephali. 1869.

,, *S. B.* ... Fieber. Synopse Bythoscopidæ. 1868.

Geof. ..... Geoffroy. Hist. des Insectes. Paris, 1764.

Germ. ..... Germar. Species Cicadarium, &c. 1830.

Kirsch. ..... Kirschbaum. Die Cicadinen von Wiesbaden. 1868.

Lat. ..... Latreille. Hist. Naturelle des Insectes. 1802.

Linn. ..... Linnæus. Systema Naturæ. 1767.

Marsh. ..... Marshal. Essay on British Homoptera. 1867.

Réaum. ..... Réaumur. Mem. pour servir à l'Histoire des Insectes. 1734 to 1742.

Sahl. ..... Sahlberg, J. Ofversigt af Cicadariæ pro Fauna Fennica. Helsingfors, 1871.

Schff. ..... Schæffer. Icones Insec. Ratisbon. 1767.

Sch. ..... Schrank. Fauna Boica. 1801.

Scott ..... Scott. Revision of the Delphacidæ. Ent. Mo. Mag., 1870.

Scott & Doug. . Scott and Douglas. Catalogue of British Hemiptera, Ent. Soc. of Lond. 1876.

Sig. ..... Signoret. Revue des Tettigonides. 1853.
Revue des Tettigometrides. 1865.
Essai sur les Jassides, &c., with plates, Ann. Soc. Ent. de France, 5 Ser., Août, 1878.

Stål. ..... Stal, A. Delphax Arten. 1854.
Hemip. Sibariens. 1858.

Walk. ..... Walker, F. Catalogue of British Homopterinæ. 1850.

West. ..... Westwood, J. W. Mod. Class. of Insects. 1845.

Zett. ..... Zetterstedt. Insecta Lapponica.

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the Mammalia, for certain pigs are known to have forty-four, and others as many as fifty-four, vertebræ.

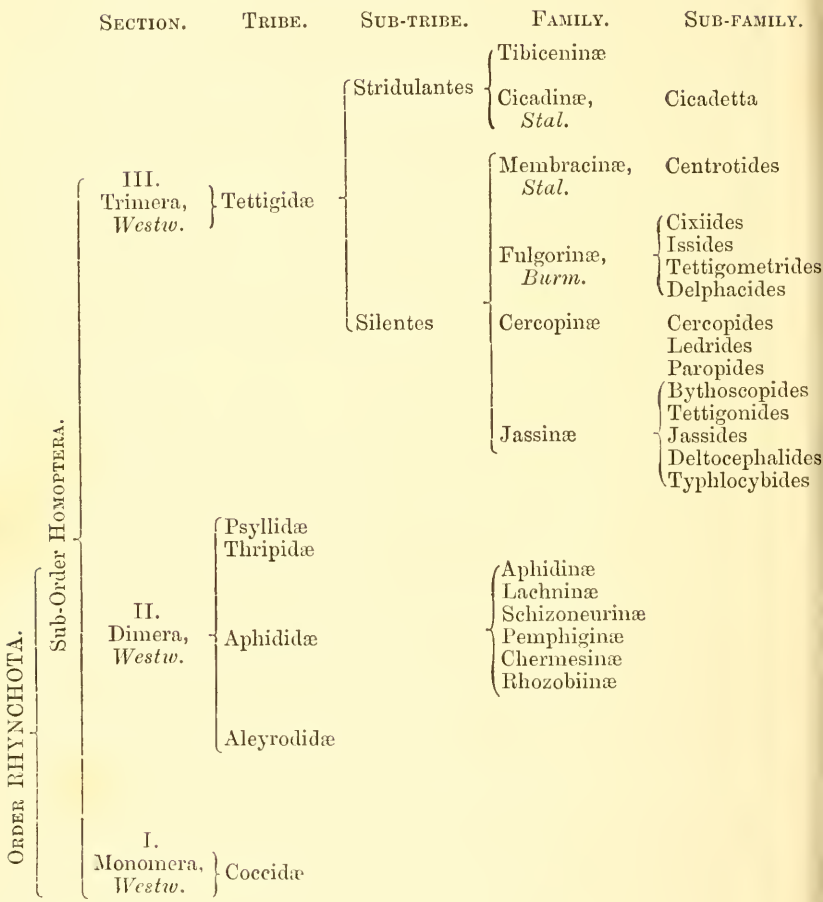
As the stripes in no two leaves of the ribbon-grass are strictly alike, so there need be no wonder that the areolets and the wing-cells of Cicadæ bounded by branching nervures will sometimes show divergences in individuals of the same species, and even that the venation of one side should sometimes differ from that of the other in the same insect. Not a few examples of such may be found in my plates. Such discrepancies, however, have not been chosen to illustrate this fact.

From what has been said it may be gathered that, although the neuration in the wings of insects is of high value for classification, it must not be implicitly or blindly followed; and this remark is particularly true as regards the numerous small Cicadæ which do not stridulate, amongst which we find it often happens that normal nervures are absent in their elytra, having been absorbed into the substance of the chitin; and that, in other instances, the presence of supernumerary nervures in the same genus are indicated by the furcation or splitting of veins into ramifications.

The following Synopsis is added to show the position taken amongst Haustellate insects by the Tettigidæ, under which tribal name I propose to combine the Stridulantes, or Stridulantia of Burmeister, and the Silentes, or Cicadelles of Latreille.

N.B.—Derivatives should proceed from the genitive case: thus Tettigidæ from "tettīgos," like Aphididæ from "aphĭdis."

Synopsis showing the relation of Cicadæ to other Homoptera.



In the 'Entomologist' (vol. xxii. p. 270) I suggested a sketch-plan for the British Cicadæ which is almost identical with the foregoing Synopsis. It met with some criticism in the following number of that magazine, the substance of which was that, as almost all the British insects are songless, they ought to be referred to different families; in short, that these insects, hitherto grouped with Cicadæ, are not Cicads at all.

It has been said that "if you take care of the species, the genera can take care of themselves." Species, for all practical purposes, are natural facts. Families, sub-families, tribes, and sections are deductions from facts; and these are different things. Necessarily, different values will be given to one or the other term, and hence we see the existence of several classifying systems. If we could have an authoritative consensus of opinion as to what shall, in future, constitute a section or a family; biological systems could be constructed on well-defined lines and recognized principles.

Fabricius's words, applied to genera, "optima nomina quæ nil significant," are scarcely applicable to wide classifications, since terms must have definite meanings to fulfil their purposes. Burmeister says, "System has the advantage of not regarding solitary characters only, but all collectively; and can therefore only separate and connect where nature has marked a separation and connection." Some may be able to give their reasons why *Cixius* has no claim to be considered one of the Cicadinæ; others may have equally strong reasons to advance the other way; and thus the weakness of a purely artificial system may be brought out.

Without questioning the point that the true Cicadinæ form a natural group, it is contended that the morphological and other differences between *Aphis*, *Schizoneura* and *Phylloxera* are greater than between *Cicada*, *Cixius*, and *Aphrophora*; yet the former groups

are not to be separated into distinct families; and therefore it is not clear why there should be any sharp separation in the latter.

In justification of the title given to this Monograph, the following synonyms are appended; being the names of the authors who have included the non-stridulous forms with the others, and who employ the term Cicadæ, or some implication of the same word, to represent a general classification of these Homoptera:—

Linnæus:	Cicada.	Sahlberg:	Cicadariæ.
Fabricius:	,,	Kirschbaum:	Cicadinen.
Schrank:	,,	Fieber:	,,
Fallen:	Cicadariæ.	Edwards:	Cicadinæ.
Burmeister:	Cicadina.	Scudder:	Cicadellidæ.

&c., &c.

Dr. Fieber reduces the Cicadinæ under eight families, commencing with Membracidæ, and proceeding to Fulgoridæ he ends with the eighth family, Jassidæ. In the first division he makes two sub-families, *viz.* (A) Tettigometridæ, and (B) Fulgoridæ. Beyond these his manuscript, unfortunately for Science, was left incomplete.

Mr. J. Edwards makes fifteen sub-families, which I here adopt. Fieber's work was published in 1872 and 1875; Mr. Edwards' Synopsis in 1886 and 1887.

Prof. Westwood, taking the three tarsal joints in Cicada as primary characters in the group, names three primary sections, thus:—

TRIMERA.

Tarsi three-jointed. Antennæ minute and setigerous. Wings areolate and semi-coriaceous.

Fam. I.—STRIDULANTIA, *Burm.*
,, II.—FULGORIDÆ, *Leach.*
,, III.—CERCOPIDÆ, *Leach.*

The first of these comprises "Les Chanteuses," or chirpers, of Latreille; the second and third comprise "Les Muettes" of the same author, and are equivalent to his Cicadelles and the Jassidæ of others.

Francis Walker, in his 'Catalogue of Homopterous Insects in the British Museum,' groups the Cicadidæ thus:—

RHYNCHOTA HOMOPTERA.

CICADINÆ. — Cicada. PHYTOPHTHIRES. — Aphididæ, Coccidæ, Psyllidæ. PHYSAPODA.—Thripidæ.

The order Cicadina he divides into families Stridulantia, Fulgorina, Membracina, and Cicadellina.

The whole Tribe has been divided by Mr. Pascoe, in his useful Manual, into thirteen sub-families; and Mr. MacLachlan recently, in the last edition of the 'Encyclopædia Britannica,' mainly adopts the same classification.

These sub-families are: — Cicadidæ, Fulgoridæ, Lystridæ, Cixiidæ, Tettigonidæ, Issidæ, Derbidæ, Flattidæ, Tettigometridæ, Membracidæ, Cercopidæ, Ledridæ, Jassidæ.

Dr. John Sahlberg, in 1871, grouped the Scandinavian Cicadinæ on very much the same plan, but he added to the above sub-families Ulopidæ, Paropidæ, and Scaridæ; and this scheme has been adopted by Dr. Franz Fieber and our later systematic authors. M. Victor Signoret, in his 'Essai sur les Jassides,' published in 1878, took the Catalogues of Fieber and Puton for a basis of his investigation; but he made several alterations in the disposition of some species; ascribing considerable importance to the position of the ocelli, which, he remarks, are very constant, and "not often difficult to find."

Here it may be noted that the characteristics often thought to be of the highest importance in general classification do fail in cases in which the species considerably vary amongst themselves.

Under such difficulties, minor characteristics may

be found sufficiently steady in their occurrence to afford safe criteria for classification.

Prof. Milne Edwards long ago showed that the most reliable characters of some lizards are to be found in such an apparently small matter as the shape of the scales of the head. The import of the scale on the seat of the pineal gland in reptiles, and the theoretical considerations advanced as to its evidence of some sense-organ now in abeyance, may here exemplify how much comparatively small matters may imply, and that they may have really high significance.

As to the ocelli in Cicadinæ, my own experience is that, whilst such organs are sufficiently obvious in genera like *Cicadetta* and *Tettigonia*, in others no ocellus can be detected even by the help of a good microscope. In many species the probable seat of an ocellus is only indicated by a simple spot of pigment. The above remarks, nevertheless, only apply to such British species as have come under my observation.

CICADINA, *Burm.*

Rostrum with two or three articulations rising from the inferior margin of the head. Palpi wanting. Maxillæ represented by fine setæ enclosed in the rostrum. Antenna constituted of two or three basal joints, terminated by a fine bristle of varying length. This seta or bristle is really formed of numerous small articulations, as seen in the Cercopidæ. Eyes two. Ocelli two or three, but often apparently wanting. Elytra deflexed, mostly coriaceous, each composed of the clavis, united to the corcum by a straight and obvious suture. The elytra are disposed over the abdomen pent-wise, each apex developing often into a delicate membranous edge (the limbus), which folds over the commissure when closed, and thus it effectively protects the delicate wings which are disposed in many doublings within. Hind tarsi three-jointed.

M. Puton describes the smaller Cicadinæ as having

ocelli before the eyes (ANTEROCELLES), and resting on the more or less angular border of the head. The Delphacidæ have the ocelli placed below, and on the gulæ or cheeks.

Mr. John Scott laid stress on the importance, in several large genera, of the shape of the genital and anal appendages. These details, together with the form and ridged character of the clypeus, pronotum, and scutellum must be duly considered.

It is believed that any attempt to describe in words the disposition of the nervures and cells of the elytra, and those of the wings, would prove of little practical use. On the other hand, drawings of such, made under the camera lucida, ought to give much assistance towards the identification of genera. Both Fieber's and Sahlberg's memoirs furnish outlines of such details, and these can be advantageously consulted.

SUB-FAMILIES OF BRITISH TETTIGIDÆ.

I. CICADIDES.

Head short and wide. Ocelli three, placed on the vertex or crown. Tegulæ wanting. Fore femora thickened and strongly toothed. Claws two, and without pulvilli. Males provided with two stridulating drums at the base of the abdomen. Elytra multicellular.

II. MEMBRACIDES.

Ocelli two, placed on the vertex. Frons or face nearly horizontal. Tegulæ wanting. Pronotum produced backwards into a horn-like process. Elytra with five apical cells.

III. TETTIGOMETRIDES.

Frons nearly flat with the gulæ or cheeks. Elytra horny, with raised nervures. Tegulæ conspicuous. The antennal setæ rising from the hind side of the second joint.

IV. ISSIDES.

Clypeus without horny marginal keels or carinæ. Elytra strongly convex at the basal portion of the costæ. Wings with numerous transverse veins. Ocelli indistinct or none.

V. CIXIIDES.

Ocelli indistinct, but placed on the frons half-way from the apex. First joint of the hind tarsi with no spur at the base. Nervures of the elytra much subdivided, and often studded with setigerous granules.

VI. DELPHACIDES.

First joint of the hind tarsi provided with a characteristic laminated spur. Ocelli on the cheeks. Second antennal joint large and tuberculated. Frons and pronotum carinated.

VII. CERCOPIDES.

Antennæ inserted between the eyes. Hind femora furnished at their bases with a strong crown of spurs, as also are the first two joints of the tibiæ. Ocelli two on the vertex.

VIII. LEDRIDES.

Pronotum with a compressed ear-like process on each side. Head large, angularly produced in front. Eyes small. Ocelli at the base of the vertex. Anterior edge of the tibiæ flat and serrated. Elytra coriaceous and multitudinously veined.

IX. ULOPIDES.

Frons convex. Pronotum without side-processes. Hind tibiæ not serrated, flattened, and triangularly prismatic.

X. PAROPIDES.

Each end of the carina, which divides the frons from the vertex, furcated. Ocelli placed in the angle. Frons flat.

XI. BYTHOSCOPIDES.

Ocelli on the frons. Hind tibiæ spurred on the edges. Vertex wide and short. Front tibiæ without spines. Cubital vein of the elytra forked. Sub-cubital vein joined by a transverse nervure to the brachial vein.

XII. TETTIGONIDES.

Frons gibbous. Clypeus very convex; portion between the clypeus and the crown rounded. Femora with two spines at the apex and on the upper side. Tibiæ multi-spinose. Ocelli a little in advance of the middle of the vertex. Elytra parchment-like and much longer than the body. Antennæ springing from sutures between the eyes.

XIII. ACOCEPHALIDES.

Vertex generally separated from the frons by a ridge. Ocelli placed near this ridge, if it be present; but if absent, on the forehead. Elytra with strongly raised nervures. Limbus none, or nearly obsolete. Pronotum marginate. Hind tibiæ four-sided, each edge furnished with a row of spines.

XIV. JASSIDES.

Ocelli on vertex. Face without carinæ. Front tibiæ spinose on the outer edge. Hind tibiæ with four rows of spines. Corium of the elytra with branched nervures. The crown or vertex of the female is generally more pointed than that of the male.

XV. TYPHLOCYBIDES.

Insects small and linear. Ocelli absent or difficult to see. Face longo-triangular. Elytra overlapping at the apex, and longer than the body. Corium with three simple nervures. Elytra non-limbated, except in the genus *Alebra*. Wings with veins carried completely to the margin.

N.B.—In the syllabic terminations of these sub-families I have followed Prof. Westwood — *e. g.*, Papilionides.

Terminology.

The Exoskeleton of the Tettigidæ accords pretty closely with that of the general Homoptera, except that certain adaptive parts appear in the abdominal segments.

The head, thorax, and abdomen are distinctly divided from each other.

The upper wings or elytra are sometimes so completely coriaceous that the name Hemiptera is not very apposite to this group.

The Head. *Caput. Tête. Kopf.*

The variable form of the head is to be noted. It occurs square, pointed, round, wedge-shaped, and even cylindrical, as in the Continental *Dorydium*. Most commonly the ocelli — in number two, or more rarely three—are placed on the vertex or crown; the crown may be raised into tubercular masses, as seen in *Cicadetta*, or at other times the surface may be flat, or five-sided as in *Ledra*. When viewed in profile, the prone and half-horizontal aspect of the frons or face is striking; and also the peculiar mode in which the antennæ spring from the under-side of the face. The head is sometimes overshadowed and partially concealed by the pronotum.

The caput is divided into the vertex or crown (*scheitel*), the frons or face (*stirne*), the clypeus (*kopfschild*), or the divided space below the frons, and below this projects the rostrum or proboscis (*schnabelscheide*). The lora consist of spaces bounded by the angles made by the sides of the frons and the clypeus; the genæ or cheeks; and the open spaces above and near to the eyes, styled the tempora, complete the under parts of the head.

On the vertex we usually find the ocelli or stemmata; but in the Fulgoridæ these are transferred to a space

below the eyes, and on the inferior surface of the head : therefore in these insects the ocelli do not look upwards. The rostrum is short, and takes its rise at the base of the clypeus, and is of variable length ; it is composed of three joints, and is folded between the coxæ. The short basal portion is often hidden behind the clypeus; the second and third joints are unequal in length ; the whole forms a sheath for the three lancet-like hairs suited for sucking. Examples of these details may be seen on Plate A, figs. 1, 2, 3.

The Eyes. *Oculi and Ocelli. Les Yeux. Augen.*

The Tettigidæ are provided with both compound and simple eyes.

The oculi are generally reniform, two in number, and placed right and left of the vertex. The ocelli, if present, number two or three, and occur either on the base or on the vertex of the crown, or else they are placed below the insertions of the antennæ.

Larval forms often show these ocelli as mere rudiments, and, indeed, in many imagos they are represented only by pigmental spots.

The ocellus has a convex transparent covering which seems to fit into a kind of cavity in the integument. But, according to J. Müller, there lies behind this a true crystalline lens, larger than it, and which corresponds with the entire circumference of the eye (see Burm. Handb. 293). The anterior surface of this lens-like body has a curvature different from that of the posterior ; its function, perhaps, is to correct spherical aberration. The optic nerve spreads itself at the posterior margin of the crystalline body, and has its corresponding pigment-cells attached. According to J. Müller a true iris lies behind this lens. The pigment of the visual organs is of different colours, partly dependent on the maturity of the insect, and partly on the time which lapsed after the insect had undergone its metamorphosis.

The appearance of an iris in some insects is often due to the presence of a highly coloured pigment disposed behind the circumference of the lens. In the Cicadinæ the colour of this pigment is red, deep brown, or black. The facets of the oculi are hexagonal, like those of most other Homoptera, each facet having its own cone lined with pigment.

By dissection the bundle of filaments which composes the optic nerve may be made visible, and each cylinder shown to have its proper connection with the cephalic ganglion. I have nothing more to add to these details, but reference may be made to John Müller's treatise on the Eyes of Insects (p. 355 *et seq.*). His investigations have been the authority for much of what is here stated.

The compound eyes of the Cicadinæ are very large. It is difficult to account for the disproportionate size of these organs in insects. We might predicate that the apparatus which collects the largest amount of light for the optic nerves would be found in crepuscular insects, and those which make their homes in dark places. In crepuscular Vertebrata, such as the cats and the owls, we notice the large eye-balls and the dilateable irides, but amongst light-loving insects we find the elaborate visual organs of the *Libellula*, the gorgeous eyes of the *Tabanus*, and the broad hemispherical compound systems of the Diptera—all these, like the sun-loving *Cicada*, sport themselves in the hot sunshine and glare of day.

Doubtless large eyes, as a rule, are connected with active habits; and, apposite to this, naturalists are familiar with the circumstance that some animals with eyes adapted for broad daylight show tendencies to lose them when bred in dark caves.

Dr. Forel's late observations on the deep-water Fauna of the Lakes of Switzerland have an interesting bearing on this point. He shows that at depths below fifty fathoms, where light does not penetrate, the eyes of *Gyrator* are absent, and that at such great depths other

species of insects also have a tendency to become blind. Accommodation to circumstances, also, would appear to occur in these Lakes, but in a different manner. There are certain larvæ whose tracheæ become charged with water, instead of air. Dr. Forel states that where these larvæ abound, the pupæ rarely occur, and that they have never been seen to rise to the surface to become imagos. On the other hand, he thinks than these larvæ are capable of perpetuating their kind through the development of sexual organs. If these insects never come to the surface it is clear that they must, like fish, extract the air which is dissolved in the water. (*Vide* 'La Faune profonde des Lacs Suisses,' par Dr. Forel de Morges, Basle, 1885.)

In the Aphididæ, which are so nearly allied to the Tettigidæ, we find several genera, including numerous species, which are quite blind. These species are almost wholly subterranean. (*Vide* 'British Aphidinæ,' vols. i. to iv., Ray Society.)

Very little is certainly known as to the office of the ocelli. By experiment Plateau found that it made little or no difference to certain insects, so far as their flight was concerned, whether their ocelli were or were not covered by a black varnish. F. Müller thought that the function of the ocelli was to focus near objects; others have suggested that they are only efficient in feeble lights. Spiders, however, must have acute vision, and yet they have no compound eyes.

As yet no perfectly blind *Cicada* has been recorded.

The whole subject of insect vision is most interesting, yet at the same time not a little puzzling. We may be arguing inconclusively, and from unsuitable premisses, that our own visual sensations are identical with those of insects. The images formed from the lenses of the insect eye seem to be formed not as with us, directly upon the pigment of the retina, but in advance of the same. We are also perplexed with the question how from three to four thousand images, all of which are

inverted, can assist the laden bee to fly in a direct line to its hive, perhaps miles distant. From the convex figure of the compound eye, again, different images must occur side by side. Can the insect be conscious only of those on which its attention is directed? Has it some power of abstraction and of concentration upon a select group of images?

Notwithstanding the labours of J. Müller, Plateau, Forel, Grenacher, Claparide, Newport, Hickson, and other competent anatomists, the conclusions arrived at are conflicting, and they show that a revision of the subject is much needed. (*Vide* Sir John Lubbock's interesting remarks, on this and kindred subjects, in 'The Senses of Animals,' Int. Nat. Series, 1888, p. 163 *et seq.*)

The Antennæ. *Fuhler.*

These organs are inconspicuous, and remarkably small in relation to the size of the insects. Their outward presence is often only to be noted by the fine compounded bristles which form their terminal joints.

The antennæ never equal the length of the body, and sometimes they do not equal the breadth of the thorax. They may be inserted below the eyes, or between them, or on the gulæ or cheeks. They are compounded of two short robust basal joints, followed by setæ having four, five, or many more articulations, which gradually taper to a point. The exact number of these articulations is not easily made out. Latreille counted only six; whilst Curtis, Westwood, and others make out seven in all. The basal joints are in communication with a minute bulb, from which the aforesaid bristle springs.

The Delphacidæ are remarkable for the peculiar forms taken by the second basal joints of the antennæ. These joints are large, and in some genera they assume different shapes, as globular, quadrilateral, pyriform, or obtuse.

Much discussion has arisen as to the function of the

antennæ of insects. If these important organs are the only auditory organs in the Stridulantes, or singing Cicadæ, they are curiously disproportionate to the large and loud-sounding apparatus of the males. Stridulation, humming, and buzzing are so common in insects that it is remarkable that the corresponding recipient organs for aërial vibrations have hardly yet been proved to exist,—unless the antennal hairs and the antennal tympana may be regarded as such.

Sir John Lubbock leans to the opinion that the antennæ are olfactory organs; yet, taking other things into consideration, he thinks that the sense of smell in insects need not be confined to these organs alone.

The Rostrum. *Schnabelscheide.*

This sucking organ rises from the hinder part of the clypeus, and is carried horizontally between the coxæ. It varies in length, but it is never very long. It is composed of three joints, the first two of which are cylindrical and unequal. The basal joint is often concealed under the labrum. Four sharp horny pieces are present, one of which—forming a sheath to the others—runs down the length of the rostrum, to constitute the sucking tube, as seen in other Homoptera. None of the Cicadæ *apparently* possess glands for secreting irritant poisons, as may be noted amongst the Aphides, which positively kill some plants by their irritative punctures on the leaves.

The four labial pieces of the mouth, converted into lancets in the Hemiptera, are styled "promuscis" by Kirby and Spence, and these authors regard this combination as distinct from the proboscis of Fabricius, which is considered by them to be a sucking tube with no lancets.

I here use the general term rostrum, and, as in the Aphides, I count normally three contained lancets, although only two appear on Plate A, fig. 7.

The Thorax. *Brust.*

The upper portion of the body is divided into the pronotum, the mesonotum, and the metanotum.

1. The pronotum is often short, and usually appears as a simple band with a posterior margin more or less cut into an angular edge. It occasionally shows protuberances at the sides, and may occur reniform, triangular, or trapezoidal. Sometimes it is wider than the head and the eyes taken together, as in *Idiocerus*. In some genera, like *Centrotus*, the pronotum has long spinous processes attached, which project over the dorsum and reach beyond the tail. These adjuncts give the insects uncouth and peculiar forms. In *Ledra* two broad leaflets rise almost perpendicularly from the sides of the pronotum. The corresponding parts of the under-side constitute the prosternum, and from it the coxæ of the first pair of legs take their spring.

2. The mesonotum forms the larger part of the thorax in the Tettigidæ. It is channelled, and provided with large lateral bosses, from the sides of which the tegmina or shoulder-scales spring, to cover the insertions of the wings. On the under-side the mesosternum carries the second pair of legs, and the opercula or lunate scales which cover the cavities within which the singing organs of the stridulating males are situated.

3. The metanotum is but little seen above. It is very narrow and deeply notched, to receive the mesonotum. The elytra and wings spring from its borders. The corresponding mesosternum gives off the third pair of coxæ with their legs. The scutellum is usually large and triangular.

I defer to another place a consideration of the anatomy and function of the sounding apparatus, which is very complex, and has engaged the attention of various physiologists, both ancient and modern.

L. melanopachys is larger than *L. venosa*, which in several respects it resembles.

Liburnia insignis was described by Scott from a single example taken by Mr. G. Norman at Pitlochry, in Scotland. (See Ent. Mo. Mag. for 1882, p. 271.)

James Scott gave also a diagnosis of *L. Dalei*. It was taken at Lulworth in August. (See also Ent. Mo. Mag. vii. p. 72.) The female is unknown.

As a key to the foregoing diagnoses of the genus *Liburnia* a selective list has been made, founded on the most obvious aspects of the insects. Though this sketch be incomplete, it may be found, in a general manner, useful towards reducing any given species to a group of perhaps four or five: the specimen then can be discriminated by reference to the descriptions given in the text. More than a dozen species remain which are not contemplated in this list; these must be separated by a microscopic examination.

Elytra.

Spotted.—Liburnia adela, capnodes, collina, discolor, limbata, lepida, straminea.

Concolorous. — L. flaveola, farinosa, pallidula, scutellata, smaragdula, unicolor.

Banded.—L. lineola, longipennis, vittipennis, guttula, striatella.

White-edged.—L. collina, leptisoma, v. albomarginata, Aubéi.

Black or brown. — L. discreta, forcipata, leptisoma, pullula, pteridis, venosa, albomarginata.

Vertex.

Protuberant. — L. collina, fuscovittata, longipennis, notula, unicolor, vittipennis.

Even with the eyes, or only slightly arched.—L. elegantula (fem.), collina (fem.), Fieberi, Signoreti, pullula, exigua, discreta, forcipata, striatella, obscurella, Douglasi, mesomelas, limbata (fem.), flavida.

Square.—L. Scotti, notula.

FRONS.

Black or brown.—L. collina, adela, discolor, obscurella, flaviola.

Yellow between the keels.—L. notula, denticauda.

SCUTELLUM.

Black or dark brown.—L. pellucida, obscurella, forcipata, venosa, discreta, lineata, limbata, discolor, exigua, lepida.

ABDOMEN.

Concolorous yellow.—L. Scotti, smaragdula,* Fieberi, Fairmairei, Signoreti, adela, pallidula, lugubrina, distincta, obscurella, striatella, mesomelas,* straminea.*

More or less suffused with red.—L. lineola, longipennis, vittipennis.

Those marked by an asterisk apply to the brachypterous females only.

GENUS XI.—DICRANOTROPIS, *Fieb.*

Frons with two isolated carinæ and one central, which last is divided or forked at about its middle. Vertex square. Clypeus convex, with three keels confluent with those of the frons. Hind tarsi equal in length with the tibiæ. Laminated spur moderate in length.

Of the four European species described, but one has been hitherto noted in Britain.

DICRANOTROPIS HAMATA, *Boh.* Plate XIX., figs. 1, 1 *a*, 1 *b*, 1 *c*.

Delphax hamata, Boh.; Flor; Marsh.
,, *notula*, H.-Schäff.
,, *striatella*, Stål.
Dicranotropis hamata, Fieb., G. D. t. 8, fig. 17; Kirschb.; Scott; Sahl.; Fieb., C. E. pt. iv. 87; Edw. p. 97.

Macropterous male. Body cylindrical. Head and eyes as broad as the pronotum. Vertex round, yellow, with three black streaks marking the position of the yellow keels. Two small dots occur at the posterior margin, followed by two larger similar ones on the pronotum. Pronotum white, with two scale-like marks on the shoulders. Scutellum yellow, and nearly three times the length of the pronotum. Four pale brown streaks mark the seats of the keels, which are nearly obsolete. Metathorax yellow. Abdomen brown, with one dorsal and numerous transverse yellow bars ; a dark round spot occurs below the point of the scutellum. Pygofer large, with two brown projecting lateral lobes, which are blunt, and support a tapering penis. The yellow internal space contains the anal tube with its brown cauda. Antennæ and legs orange-yellow. Elytra hyaline, and about twice the length of the abdomen. The veins fine and brown, furnished with delicate setæ. The five apical cells are long, and disposed something like those of *Liburnia scutellata*. Wings iridescent, and rather liable to variation, even in the same insect. Frons yellow, with three strongly marked carinæ, which, diverging from the insertion of the labrum, proceed through the clypeus to the base of the eyes, and run over the frons to the crown above. The central keel forks at about its own middle, and each limb runs over the vertex and forms four carinæ on the crown. Some specimens show a short brown line at the apex of the elytra, and have black hind legs. The second antennal joint is about three times the length of the first ; it is yellow, dilated at the tip, rough, and ends with a small bulb with the seta.

Brachelytrous female. The upper parts are coloured much like those of the male, only paler. The abdomen is yellow with brown blotches on the sides, and a series of brown spots down each side of the dorsum. Anal tube cylindrical, ending with a brown cauda. Elytra hyaline, grey, and about half the length of the

abdomen. The male also occurs in the Brachelytrous form.

Found throughout almost all Europe, and common in England. Taken at Malvern, Haslemere, and Norwich.

	Inch.	Millimetres.
Expanse	0·32	8·10
Body	0·12×0·04	3·05×1.01

Genus XII.—STIROMA, *Fieb.*

Frontal carinæ filiform, four in number. The two middle keels run parallel and meet at the clypeus, or else they fuse into one just before they there meet. Sometimes the keels are faint in their development, and difficult to see. The frons then appears as square and nearly flat, as in *Stiroma pteridis*. Usually they form four deep ridges on the vertex. Antennæ inserted on the cheeks, just below the eyes, the second joint being twice as long as the basal. Pronotum short, and about as wide as the head and eyes together. Mesonotum broad and deep, with a sinuous posterior margin. Scutellum small and semilunar. In the pupal forms, the carinæ appear as white cross lines, and mark the edges of the rudimentary elytra. Elytra short, coriaceous, with from five to six apical nervures, which are singly forked (isolement fourchues). Hind tarsi rather shorter than the tibiæ. The styloid processes in some species have the form of a fish-tail, but in others they are aculeate, and recurved at the points.

The species are small and very nimble in their leaps, so as to make it difficult to secure them.

STIROMA ALBOMARGINATA, *Curtis*. Plate XX., figs. 1, 1 *a*, 1 *b*, 1 *c*, 1 *d*, 1 *e*.

Delphax albomarginata, Curt. ; Marsh.
,, *mœsta*, Boh. ; Stål.
,, *collina*, *collaris*, Stål.
,, *adelpha*, Flor.
Ditropis adelpha, Fieb., G. D. t. 8, fig. 18 ; Kirschb.
Stiroma adelpha, Fieb., C. E. pt. iv. 91.
,, *albomarginata*, Scott ; Edw. pt. 1, 94.

Brachelytrous male. Oval, stout. Head with eyes nearly as wide as the pronotum. Frons with four white keels, the two middle joining at the clypeus, without a fork. Scutellum reddish brown, broadly triangular. Eyes large. Second antennal joint much the largest, finely pilose, and projecting far beyond the eyes ; colour rufous. Elytra pitchy black, with broad white apical bands or margins. Length about half that of the abdomen ; the principal nervures rufous. Abdomen black. Pygofer yellowish, with a deep notch and triangular horizontal styles spreading outwards. Legs stout, ochreous-yellow ; hind tibiæ with one outer spine placed above the middle, followed at the base by the usual laminated spur, and other spines.

The Brachelytrous female has an ochreous body with yellow tinting. Elytra shorter than in the male. Pygofer without lateral appendages, and bright yellow. Edges of the elytra, and edges of the abdominal rings, white. All the under side is yellow, except the lateral parts of the abdomen and the saws, which are brown.

The larger size of the female is to be marked.

Macropterous forms have their elytra twice the length of the abdomen ; they are not often met with.

Size, 3·5 to 4·0 millimètres, or 0·14 to 0·16 inch.

Common in the Romney marshes, Kent, and in moist meadows, in May and June.

Stiroma borealis, *Sahlb.*

Ditropis borealis, Sahlb.
Delphax mœsta, Flor.
Ditropis mœsta, Fieb., G. D. t. 8, fig. 18.
Stiroma mœsta, Scott; Fieb., C. E. pt. iv. 92.
,, *borealis*, Edw. pt. i. 94.

The Brachypterous female is in appearance very like that of *S. albomarginata*, but it is more obtuse in the shape of the abdomen. Colour ochreous, with white carinæ. The pygofer of the female is of a shape widely oval, or a long trapezium. The styles of the male are ensiform. The lateral plates of the female nearly straight, and white in colour.

My diagnosis is from a foreign specimen named by M. Lethierry, and in Mr. Mason's cabinet. I have taken Mr. Edwards' synonymy for this species.

Stiroma affinis, *Fieb.* Plate XIX., fig. 3.

Stiroma affinis, Fieb., G. D. t. 8, fig. 18; C. E. pt. iv. 96; Edw. pt. i. 95.
Stiroma nasalis, Douglas.

Brachelytrous female fusiform, more acute at the abdominal apex. Colour uniformly ochreous-yellow, with two faint brown marks at the junction of the scutellum and the pronotum. The first part of the pronotum one-half longer than the second. Abdomen with strongly marked rings, and in some examples with a dark stripe on each side. Pygofer tri-acuminate, the central style projecting beyond the outer plates; the mouth roundish pyriform. Tibiæ and tarsi of the hind legs stoutly spurred. Claws black. Elytra grey, and only one-third of the length of the abdomen. A dark spot occurs on each side of the frons.

Macropterous female. Vertex and frons brown. Scutellum twice the length of the abdomen.

I have examples from the Norfolk woods, where Mr. Edwards says this species is not uncommon.

STIROMA NIGROLINEATA, *Scott.* Plate XIX., figs. 2, 2 *a* to 2 *d*.

Eurybregma nigrolineata, Scott.
Stiroma nigrolineata, Edw. pt. i. 96.

Macropterous female. Head broad. Vertex square between the eyes, yellow, with a transverse angular streak, which occasionally is variable in form. Eyes yellow, with a brown pigmental spot within. Frons yellow, with strong white keels; those in the middle are united until a little below the eyes, where they furcate and pass over the vertex. A short transverse carina separates the clypeus from the frons. Pronotum and scutellum yellow, with two broad longitudinal and two transverse marks which variegate the same. Elytra nearly twice the length of the abdomen, greenish grey, with brown nervures. A broad brown band passes round the costal edge and also the apex. This band is continued almost to the base and near to the suture.

Brachelytrous male oblong, yellow, with seven brown dots on the vertex which indicate the pits of the carinæ. Pronotum with its posterior edge sinuous, and about two-thirds the length of the scutellum. Two dark longitudinal lines run down both these segments, and pass into two wider stripes on the abdomen. The abdomen is concolorous yellow, the somites being marked by brown edges and conspicuous stigmata. Pygofer square, with a deep circular notch. Mouth of the pygofer short-pyriform, with an upper indentation. Styles brown, pointed, tapering, and curved, with a straight penis between them. Two strong prehensile

spurs occur below the anal tube, similar to those seen in *Liburnia straminea*. Femora each with a black stripe.

Brachypterous female is larger, but coloured very much like the male, and it strongly shows the three dark lines which give the insect its specific name.

Sometimes these insects are so dark in colour that they may be described as having yellow lines on a brown body, instead of *vice versâ*.

I have received numerous examples of these insects which were taken by sweeping in Fawley Wood, Norfolk. They were captured by Mr. Edwards in the month of June. *Vide* J. Scott's paper in Ent. Mo. Mag. vol. ii. 92.

	Millimetres.	Inch.
Expanse	10·0	0·39
Body of male	3·8	0·15
,, female	4·8	0·19

Stiroma pteridis, *Boh.* Plate XX., figs. 3 to 3 *c*.

Delphax pteridis, Boh.; Stål; Marsh.
Ditropis pteridis, Fieb., G. D. t. 8, fig. 18; Kirschb.
Stiroma pteridis, Scott; Fieb., C. E. pt. iv. 94; Edw. pt. i. 94.

Brachelytrous male. Form oval. Head, pronotum, and scutellum lemon-yellow. Antennæ large and yellow. Eyes brown. Abdomen dark sienna-brown, with the dorsal stripe and all abdominal edges yellow. Elytra nearly half the length of the abdomen; colour shining bluish black. Legs yellow; femora each with a brown spot at the knee, and a dark streak. Frons a long trapezium, with four yellow carinæ on a dark ground; middle keels not confluent. Clypeus short and triangular. Mouth of the pygofer rhomboidal, somewhat arched at the top, and angular below. Anal tube whitish, with a black cauda. Interior of the pygofer black, with brown leaf-like styles, which are finely pilose. Tarsi black.

Brachelytrous female. Larger and paler than the male, with almost grey elytra. The frons is squarish, with the keels nearly obsolete.

The Macropterous form is rare, and I have not seen it for description.

The immature forms are common in some localities, feeding on the common brake, *Pteris aquilina*. I have taken specimens on the Malvern Beacon in July.

Size of body, 3·30×1·54 millimètres, or 0·13×0·06 inch.

Stiroma bicarinata, *H.-Schäff.*

Delphax bicarinata, H.-Schäff.
,, *nasalis*, Boh.; Flor; Marsh.
,, *mutabilis*, Boh.
Stiroma mutabilis, Fieb., G. D. t. 8, fig. 24.
Ditropis bicarinata, Kirschb.; Sahl.
Stiroma nasalis, Scott; Fieb., C. E. pt. iv. 95.
,, *bicarinata*, Edw. pt. i. 96.

Two black spots, free or confluent, form a band above the clypeus. Pygofer, seen from behind, pentagonal, when seen from above "transversalement quadrangulaire" (Fieb.), with a deep notch. Elytra of the male hyaline, with yellow nervures.

The only insects that I have seen of this species are from the cabinet of Mr. P. Mason. Originally these were sent to Scott by M. Lethierry, and they now have Scott's printed labels upon them, as foreign specimens. I cannot from these make out sufficiently distinct differences to place a specimen on a plate for comparison with *Stiroma affinis*, particularly as these examples are so gummed on card that I could only in a general manner study the pygofer of the male. Fieber's outlines of the pygofers of the Delphacidæ are clearly traced, but they are too small in many instances to afford good materials for comparisons.

Mr. Edwards says, "I have examined one undoubted male from Dr. Capron's collection," which remark shows that this insect is rarely taken in Great Britain.

Fieber constructed the genus *Achrotile* to receive two insects which are closely allied to *Stiroma*, but show, as one chief difference, the development of numerous tubercles on the frons and the edges of the carinæ. Mr. J. Scott admitted *Achrotile* into his list of Cicadinæ, and Dr. Puton also recognised *Achrotile bivittata*, *A. albosignata*, and *A. longicornis* in his Catalogue. Mr. Edwards, however, has shown that the pupa of *Liburnia Fairmairei* is also characterised by tubercles on the frons, and he considers (*vide* Synopsis, *l. c.*, pt. i. p. 86) that this last-named insect is identical with *Achrotile bivittatus* of Boh. and of Fieber, and of Puton's Catalogue.

Through the kindness of Mr. P. B. Mason, of Burton-on-Trent, I have had the opportunity of examining two specimens of *A. albosignata* which originally formed part of Scott's collection. One of these is of a ferruginous-yellow colour, and has much the appearance of a larval form. The elytra are not disengaged from the wing-cases, and the pygofer is only partly developed. "Quelques pustules blanchâtres sur les carènes du pronotum, une pustule à l'extrémité de la carène latérale du mesonotum," are present; and, besides these, three rows of tubercles run down each side of the abdomen. The other specimen, which is in bad condition, nevertheless shows the four parallel keels and the deep pit which receives the basal joint of the antenna, and also the large pustules noted by Fieber, whose figure well represents this insect. The carinæ, however, are less raised than in Scott's example.

In my Plate III., fig. 8, which represents an *Issus*, simi ar pustules occur, and the same reasons which suggest that this represents the nymph of an *Issus* lead me to the belief that Scott's insects are immature forms also.

Mr. Edwards says that the pupæ of *Liburnia unicolor*, *L. forcipata* and *Stiroma pteridis* show all the important characters of *Achrotile;* and, further, that amongst some hundreds of nymphs he examined, although he could not decide on the species to which they belonged, they exhibited the same tuberculose faces.

Mr. Edwards discusses this question pretty fully in the Ent. Mo. Mag. for August, 1885, p. 67, and he thinks that we are not, and shall not be, in a position to say that the genus *Achrotile* is British, until we have more adult foreign examples to compare with.

Nevertheless Boheman and Stål agree that *Achrotile* is a good species, whilst other authors consider it to be an undeveloped Delphacid of some undefined kind. The Rev. J. A. Marshal believed it to be the larva of *Liburnia neglecta*. Mr. Edwards gives significance to the fact that *Liburnia brevipennis* and *Stiroma bivittata* may be taken *together* at the roots of dry grasses, from the middle of August to the middle of October, after which time they all apparently go down for hybernation.

Mr. J. C. Dale captured eight pupal specimens of *Liburnia albosignata* in October, at Bonchurch, Isle of Wight. Scott compared these, which were of both sexes, with an insect given to him by Dr. Stål, and he considered them all to be identical. He remarks on the white margins to the basal abdominal rings as characteristic.

Genus XIII.—CHLORIONA, *Fieb.*

Chloriona farinosa, *Buckton.* Plate XXI., figs. 1 to 1*c*.

Macropterous male. Form elongated. Vertex projecting quite one-half beyond the eyes. Pronotum short, about half the length of the vertex. Scutellum twice the length of the pronotum. Elytra long and lanceolate. Legs yellow; all the femora are marked with two fine brown parallel stripes. Claws black.

Frons long, with three rather marked keels; the mid-keel is unforked, and narrowed with the outer ones to the scutellum, the carinæ being carried through it to the labrum. Second antennal joint spotted, and more than three times the length of the basal joint. Eyes large and greenish grey. The general colour of this insect is greenish ochreous-yellow. The carinæ are nearly white. At the apex of the elytron a small brown forked streak occurs, and just before the sinuous transverse nervures two black dots are placed, and succeeded by a larger dot at the point of the suture. The costal rim is rough and strongly thickened. The lower margin of the clavus also is thickened in a less degree. All the under-side yellow, with black abdominal rings edged with white. The pygofer on the under-side is nearly concealed by a quantity of white mealy matter, from which alone the anal process protrudes. No setigerous granules occur on the elytra. In this respect this insect fails to answer to any of the five species named by Fieber under his genus *Chloriona*. One other character also he gives which differs from the diagnosis of the above insects:—Vertex elongated, trapezoidal, visibly longer at the nape of the neck ("à la naque") than at the summit, and the second long apical nervure of the elytron alone forked. (*Vide* Part II., p. 35,)

The above-described insect has some affinity to *Liburnia smaragdula* and *L. unicolor*. The peculiar neuration and mealy character seem to justify its being regarded as a new species.

Size, with elytra, 4·56 × 1·52 millimètres, or 0·18 × 006 inch.

Taken sparsely on sandy banks at Weycombe, Haslemere, in May.

Before closing the diagnosis of the Delphacidæ I add a few of the observations made by Fieber on his genus *Achrotile*. They may be considered with reference to the immature forms of *Stiroma pteridis*:—

"Frontal keels raised and running parallel to the vertex (*Scheitel*), furrows shallow. . . . . Four bowl-shaped tubercles (*napf formige Pasteln*) occur beyond the under-sides of the border, and also several others on the side keels of the pronotum. Basal joint of the antenna twice as long as thick, and three-quarters the length of the cylindrical second joint. Frons broad, rectangular, and rather narrower below."

From the above it would appear that the chief character of Fieber's genus *Achrotile* consists in the pustules. See my Plate XXI., figs. 2 and 2 *a*.

CERCOPIDÆ.

Frons gibbously convex. Ocelli two, placed on the vertex between the eyes. Antennæ inserted before and between the eyes, and just under the vertex. Pronotum notched at the base. Scutellum small, or moderate in size. Front femora unarmed, and not thickened. Hind tibiæ furnished with one or three spines on the shanks, and provided with a crown of strong spines at their bases, just above the tarsi. Tarsi with distinct claws and pulvilli. Elytra coriaceous, punctured, and folded pentwise. Non-limbated. Wings with three apical cells, bounded by a peripheral vein.

Sahlberg describes the Norwegian and Swedish species under five genera. The British species at present are restricted to only three, *viz.*—

I.—TRIECPHORA, *Am. & Servir.*
II.—APHROPHORA, *Germ.*
III.—PHILÆNUS, *Stal.*

Perhaps the most obviously distinctive character of the British Cercopidæ is the form of the stout hind femora and tarsi, each furnished with its whorls of spines. A guide also to the separation of species may

be found in the forms of the thorax and the scutellum. The males of the Cercopidæ are smaller, but brighter in colour than the females, which observation is in accordance with Mr. Bates's remarks on this sex of insects generally.

The singular mode adopted by the larvæ for concealment has been long known. Germar notes it in the generic name he gave to the Family *Aphrophora*, from ἀφρος and φερω (froth-bearing). The habit consists in forcing numerous bubbles of air, which are discharged from the tail-end, through a tenacious liquid secreted by a special organ. A drawing of this organ may be found in my Plate B, figs. 8 and 9. The soft-bodied larvæ live pretty secure from their enemies under this spume, and comparatively they are unaffected by the droughts of summer. A single mass of froth may contain more than one individual; and also within it several exuvia, or casts of the previous stages of growth, may be seen complete, even to the joints of the antennæ and to the long setæ of the proboscis. The froth is most abundant in moist weather, and then it will fall in drops from the food-plants, but in dry weather it concentrates up to a certain point, and then evaporation would seem to cease. The fluid can be drawn between the fingers into viscid threads; yet when evaporated on a slip of glass, it merely leaves behind a gummy mass, which shows no particular structure under the microscope. Alcohol throws down a flocculent precipitate from aqueous solutions.

The larvæ when plunged into water become restless, and emit a stream of air-bubbles, after which they will remain quiescent, as if dead, for more than an hour. If taken out of the water they speedily revive. The tenacity of life is remarkable in these young forms, for they will exist for a considerable time when put into petroleum spirit; and even when dissected the viscera, including the organ which secretes this spume, will show a curious peristaltic movement after an hour's submergence. What may we augur from these visceral

details ! Will it suggest questions to those who maintain that germs of organs (somehow) spontaneously rise, which will develop and become hereditary if they prove economically beneficial to the animal ?

Although I have kept " cuckoo-spits " alive for four days, under watch-glasses, without food, the insects are very sensitive as to freshness in the character of their food. When the sap of the plants in the least deteriorates, the larvæ crawl out of the spume and wander over the plants until they die. The habits of these insects, therefore, are not easy to watch in confinement.

The convolutions of the intestines are very long and intricate. Léon Dufour says that when unravelled they are more than eight times the length of the body. The tracheæ are numerous. The œsophagus is straight, and terminates in a rostrum with three long bristles, as in *Aphis*.

The Cercopidæ feed on numerous plants and shrubs, such as *Rumex*, *Rubus*, *Veronica*, *Scabiosa*, *Rosa*, *Salix*. Also they may be taken on many Compositæ, and on various grasses.

The very common *Philænus spumarius* is very indiscriminate in its choice of food-plants.

The elytra and wings of the Cercopidæ are large, yet the insects make no long flights. On the other hand, the numerous spines on their legs give a good foot-hold for long leaps which the wings help to sustain. The insects run quickly and often, with an odd sideways motion like that of the crab.

Some literary interest attaches to the name Cercopidæ. Ovid tells us* that the Cercopes were the inhabitants of Pithecusa, an island in the Mediterranean Sea, who

* *Vide* Ovid, Med. 14, v. 91. Also 'Cistula Entomologica,' Κερκος Κερκωψ, a tailed beast, a cheat, a howling monkey. Ancient beliefs, with a love of the marvellous mixed with credulity, find exponents in our day. In the author's knowledge a question was raised amongst some friends as to the origin of cuckoo-spit. A wag gravely stated that the bird made itself hoarse by singing his oft-repeated note, and that during the fits of silence he relieved his throat in the manner shown on vegetation around. An otherwise intelligent auditor accepted this explanation as satisfactory, just in the same manner as our forefathers have done.

for their dishonesty and subterfuge were turned into monkeys. Most of the species of this group of insects show, when viewed in front, a grotesque monkey-like face, with swollen striated cheeks, which fact, coupled with their concealed habits, probably suggested this name to Germar.

The Cercopes were the subjects amongst the Greeks for ludicrous and comic poetry.

Zoologists retain the name *Cercopitheca* for our long-tailed monkeys.

Dr. Stål divided the Cercopidæ into two groups, based on the varied forms of the thorax. Sub-tropical species are very numerous, and many have been described by him, by M. Fargeau, Mr. F. Walker, and others. Mr. Butler, in 1884, described 126 species, chiefly the inhabitants of the East Indies, Singapoor, and Macassar. Mr. Wallace also obtained numerous insects from Central America.

Cercopis Strongii, Westw., is an ancient form, and, amongst other Tettigidæ, occurs in the semi-fossilised resin known as gum anime.

Genus XIV.—TRIECPHORA, *Am. et Serv.*

Triecphora vulnerata, *Illig.* Plate XXII., figs. 1 to 1*b*.

Cercopis sanguinolenta, Panz.; Burm.
,, *vulnerata*, Illig.; Curt., Brit. Ent. pl. 461; Fieb., C. E. pt. viii.; Kirschb.
Triecphora sanguinolenta, Marsh.; Edw. pt. i. p. 97.

Body shining black both above and below, delicately pubescent. Head flat. Vertex rounded. Eyes moderately large, and partly inserted above and partly below the frontal edge. Antennæ placed between the eyes. Pronotum indented into lobes. Scutellum triangular. Abdomen broad, flat, and ringed. Saw-case of the female projecting beyond the apex of the abdomen. Elytra punctured, rounded at their apices, bright

crimson with a broad black semilunar band near the apex, succeeded by two other transverse bars broadly united at the costal and marginal edges, so as to form an irregular circular red spot. Wings with a dusky membrane and black nervures. Profile of head flat and thin. Frons or mask striated with yellow. Legs black; hind tibiæ with two strong spines. Tarsi also fringed with spurs.

	Inch.	Millimètres.
Expanse	0·82	21·0
Length	0·39	10·0

Scott remarks on the fact that several genera of Tettigidæ, which are numerous in species in other countries, are only represented here by single ones. Thus we have but one representative of *Cicadetta*, one of *Issus*, of *Tettigometra*, *Delphax*, and of *Cercopis*. Although *T. vulnerata* is common in Lincolnshire, it has not been recognised in Scotland or Ireland. The insect is so conspicuous from its size and colour that probably it would have been noted if indigenous in these limits. As it does not occur in Sahlberg's 'Fauna Fennica,' it probably is unknown in Scandinavia. The insect, however, is not uncommon in Edlingham Wood, near Doncaster, and at Huddersfield in Yorkshire, and I have repeatedly taken it in the high woods above Haslemere, near alder bushes.

The Cercopidæ are early represented in the European strata. Sixteen fossil species have been already noted. One, very closely allied to *Triecphora*, has been disinterred from the strata of the Isle of Wight; and in America Mr. Scudder has found a dozen or more species in the Florissant beds, which formation contains also in abundance Aphides and other Homopterous insects. This insect also has been taken plentifully in Syria by the Rev. F. A. Walker.

The word *Triecphora* appears to be a barbarous word, and perhaps it was not meant by its coiner to have any special meaning, or was it originally written *Trichophora?*

Genus XV.—APHROPHORA, *Germar.*

Vertex angular. Ocelli two, with a distance between them more than twice that from the eyes (Stål). Vertex carinated in its midst. Pronotum trapezoidal. Scutellum small, anteriorly rounded. Posterior tibiæ furnished with two spurs; numerous spurs also fringe the tarsal joints. Elytra without limbus. The species are relatively large.

Aphrophora alni, *Fall.* Plate XXII., figs. 2 to 2 *e*.

Cercopis alni, Fall.
,, *bifasciata*, Fab.
Aphrophora spumaria, Germ.; Burm.; Am. et Serv.
,, *alni*, Flor; Marsh.; Kirschb.; Scott; Sahl.; Edw. pt. i. p. 97.

Head and eyes as broad as the pronotum. Vertex with a carina, and a small plate at the apex. Pronotum with a yellow suture, which is carried at right angles to the vertex. Whole insect umber-brown, with the exception of a conspicuous pale fulvous costal spot succeeded by another smaller triangular one on the elytron. Abdomen dark brown, with a tendency to fulvous at the edges and tip of the tail. Whole insect, except the abdomen, punctured with black, except on the white parts of the elytra. Legs reddish. Elytra pale fulvous, with broad irregular brown bars enclosing pale spaces. Elytral nervures brown. Wings blackish grey, with dark nervures. Under-side pale umber. Abdomen darker. Frons or face with numerous punctures, pubescent, swollen, and with an outer ridge. Rostrum projects much beyond the third coxæ.

Some specimens are brighter than others, and this applies more particularly to the males. The food of these insects is not restricted to the alder tree. They may be taken often on the long grasses underneath these bushes.

Larva of Aphrophora alni. — Oblong; with head, prothorax, legs, and tip of the tail pale green. Abdomen tumose, bright yellow, with white edges to the rings. Eyes variable as to colour and conditions of maturity, but usually pale green with red pigmental cells. Frons or mask much swollen.

Size, 10·0 millimètres, or 0·40 inch.

Pupa. — More linear than the larva. The head smaller. Eyes black. Wing-cases brown. Abdomen orange-yellow. Colour brighter underneath. Legs green, as also is the saw-case in the female. Frons with pale transverse striations.

When the larva is removed from its covering of froth, it repeatedly lengthens and contracts the rings of its abdomen, shortening them like the slides of a telescope.

It is fairly common on the marshes of Godalming and Haslemere, but is very plentiful at Brockenhurst, Hampshire.

	Inch.	Millimètres.
Expanse of imago	0·75	18·97
Body	0·35×0·09	8·89×2·22

APHROPHORA SALICIS, *DeGeer.* Plate XXIII., fig. 1.

Cicada spumaria salicis, DeGeer.
Cercopis rustica, Fab.
Cicada salicis, Fall.
Aphrophora salicina, Am. et Serv.
,, *salicis*, Flor; Marsh.; Kirsch.; Scott; Sahlb.; Edw. pt. i. p. 97.

General colour ochreous-yellow, almost concolorous. Whole body and elytra finely punctured. Eyes brown. Nervures of elytra paler. Sometimes the trace of a white spot may be seen on the costa.

This insect is far rarer than the preceding, and is a trifle larger than it. It may generally be separated from *A. alni* by the absence of brown barrings on the elytra.

Size, from 10·0 to 10·5 millimètres, or 0·39 inch.

Genus XVI.—PHILÆNUS, *Stål.*

Body oblong or sub-linear. Head often deltoid. Vertex not carinated above; fore-margin sulcate. Ocelli equally distant from the eyes as they are from themselves. Rostrum not projecting beyond the second coxæ. Scutellum small, longer than broad. Wings not folding or overlapping at their apices. Inter-marginal vein not interrupted.—(Stål.)

The larvæ conceal themselves in foam, whence the generic name *Ptyelus* given to the species by Flor and by Scott, from πτυω, I spit.

Only four British species are generally recognised as such. Scott says that "they are strictly attached to grasses and low plants," and that they "never occur on trees and shrubs except by accident."

Philænus spumarius, *Linn.* Plate XXIV., figs. 1 to 3.

Cicada spumaria, DeGeer.
Cercopis spumaria, Fab.
Aphrophora bifasciata, *leucophthalma*, *lineata*, &c., Germ.
Ptyelus spumarius, Flor; Kirsch.

The synonyms of this common species are very numerous, and need not be given here. Sahlberg's 'Cicadariæ' may be consulted for numerous varieties, which are often strongly marked both in colour and form.

The larva is soft and fleshy, and differs in several ways from that of *Aphrophora*. Colour greenish, yellow, or brown. It usually feeds with its head downwards. Both the pupæ and larvæ blow up bubbles of foam. The froth is a trap for many small insects, grains of pollen, and small organisms. Red spots on the head of the larvæ indicate the sites of the future ocelli. The antennæ may be shown to consist of numerous (at least seven) joints, as in *Cicada* proper (see Plate

XXIV., fig. 1 *c*). The soft parts of the larvæ are well suited for the study of the viscera.

Changes of skin occur several times before passing into the pupa, and these are made within the spume.

As *P. spumaria* can blow as many as seventeen bubbles in the course of half a minute, the air probably is drawn into the spiracles, and then forced from the anal opening through the tenacious liquid.

After remaining on the herbage for a week or more, the frothy mass thickens from evaporation of the watery particles, and then it forms a cavity, within which the final transformation is effected.

Sometimes the larva becomes the prey of a small Hymenopterous parasite. I have met with two instances of such, where the globular mass of spume has dried into reticulated threads, and formed a network over the dry carcase of the pupa (see Plate XXIII., fig. 2*b*).

Mr. Darwin attributed little to the effect of climate in modifying species. He urged that species spread over a wide range show a greater variability than those scattered over a limited range. It is worthy of remark that this aphrophorous habit is common to the genus over many parts of the world. According to Bennett *Aphrophora gondotii*, a Madagascar species, emits a large quantity of clear watery liquid, which drops freely from the trees even in the hottest time of the day. Ants are said to resort to these insects for moisture, but a similar habit has not been observed by me in English ants.

If we ignore climatal action, it seems to increase our difficulty in explaining the extreme variability of *Philænus spumaria*. No less than eighteen clear varieties are noted by Sahlberg, thirteen of which are sufficiently marked to induce authors to give them distinct names. As before stated, but four only of these are now considered to be true species. It may be so; yet form, proportion, colour, and markings are so different amongst them, that, until more is known of their life-history, some may hesitate certainly to decide for or against their specific value.

Although the hunting spiders will not prey upon Aphides, it is said that they will carry off small Cicadæ for food.

Dr. Sahlberg describes the genus *Philænus* under seven species. Messrs. Douglas and Scott reduced these to four, which number Mr. Edwards also adopts. The chief difficulty in separating these relates to *P. campestris* and *P. lineatus*, for they do not very obviously differ either in colour or in size. The significance of the white costal line, succeeded by a dark one on the elytron, is not a strong specific character; for the large variety of *P. spumaria* = *fasciatus* of Fab., has this line very pronounced, and so also has the var. *leucocephalus*.

Last summer I received from Mr. Mosley the result of about two hours' sweeping, with a net, of some grasses near Huddersfield. The haul almost entirely consisted of examples of *Philænus*, and the individuals must have numbered more than one thousand. After the separation of the small *P. exclamationis*, the rest could be readily grouped into four varieties. The remainder, which were principally ochreous-yellow, and had mostly elytra with parallel sides, I referred to *P. lineatus* and the rare *P. campestris*. Whether this last be a distinct species I will not here decide. All the *Philæni* feed on grasses, and their separate life-histories are in a great measure unknown. The diagnosis of *P. campestris* is not of that decided character which allows of a sharp separation.

The following list comprises the most remarkable varieties of *Philænus spumarius*:—

Var. 1, *populi*, Fab. — Concolorous yellow; eyes reddish. Length 6·0 mill. or 0·23 inch.

Var. 2, *fasciatus*, Fab.—Large. Head and pronotum yellow. Elytra slightly punctate and finely pilose. Yellow, with three rich brown bars occupying the basal, middle, and apical parts. Legs pale. Underside of the body all black. The males, which breed late in August, are broader in the head, and have rich

warm tortoiseshell markings. The females later in the year contain from eight to ten long white ova. Length of the insect, 5·0 mill.

Var. 3, *leucocephalus*.—All black, except the head and upper part of the pronotum, which are pale yellow. Length 6·0 mill., or 0·23 inch.

Var. 4, *leucophthalmus*, Linn.—Wholly black. Length 6·0 mill.

The first three of these varieties are figured in Plate XXIV., figs. 1 to 3.

A species of *Philænus* is known as a pest in South Africa under the name *Philænus caffeæ*.

PHILÆNUS LINEATUS, *Linn.* Plate XXIII., fig. 3.

Cicada lineata, Linn.
Cercopis lineata, Fall.
,, *abbreviata*, Fab.
Ptyelus lineatus, Flor; Marsh.; Kirschb.; Scott.
Philænus lineatus, Sahl.; Edw. pt. i. p. 100.

Body linear. Colour ochreous-yellow. Costa with a white stripe, and another dark one which runs parallel to the costa. Pubescence short and thick. Punctuation fine. Pronotum with five impressions in the form of an arc.—(Sahlb.) Base of the pronotum scarcely broader than the head. Several varieties of this species are pitch-black, with whitish costæ.

Length, 4·5 to 6·5 millimètres, or 0·17 to 0·25 inch.

Very common in long grass.

PHILÆNUS EXCLAMATIONIS, *Thun.* Plate XXIV., fig. 4.

Cicada exclamationis, Sahl.
Cercopis exclamationis, Fall.
Ptyelus exclamationis, Flor; Marsh.; Kirschb.; Scott.
Philænus exclamationis, Sahl.; Edw. pt. i. p. 100.

Elongated, fuscous-brown. Body strongly punctured, more finely so above, and furnished with a fine pubescence. Sides of elytra, when folded, nearly

parallel, and narrowly rounded at the tips. General colour bronzy green or brown. Costa with a widening stripe of white, succeeded by a triangular spot of the same tint, and again by another white spot at the suture, giving on each elytron the form of a note of exclamation. Under-side of the head, the legs, and the sides of the pronotum, yellow. Some insects are almost entirely black.

Of all the British species this is the smallest. It is not very common at Haslemere.

Size 3·5 to 4·0 millimètres, or 0·13 to 0·15 inch.

PHILÆNUS CAMPESTRIS, *Fall.* Plate XXIII., fig. 4.

Cercopis campestris, Fall.
Ptyelus campestris, Flor; Kirschb.; Scott.
Philœnus campestris, Sahl.; Edw. pt. i. 99.

Colour, fawn or yellowish brown. "Breadth across the posterior margin almost four times wider than the centre." Costa white at the base, with two angular spots behind. Puncturing and pubescence as in the last species. The vertex and the scutellum sometimes have a brown middle stripe.

Size, 4·0 to 5·0 millimètres, or 0·15 to 0·19 inch.

Least common of all the species. Scott says the length of the crown alone is sufficient to separate *P. lineatus* from *P. spumarius*, and from *P. campestris*.

LEDRIDÆ.

GENUS XVII.—LEDRA, *Fab.*

Head foliaceous, somewhat pentagonal in shape. Eyes globose. Ocelli two, close together, and near to the base of the vertex. Elytra subcoriaceous and many veined. Hind tibiæ flattened and densely ciliated.

LEDRA AURITA, *Linn.* Plate XXV., figs. 1 to 8.

Cicada aurita, Linn.
Membracis aurita, Fab.
Ledra aurita, Fab.; Germ.; Burm.; Curt.; Kirschb.; Sahl.; Edw. pt. i. p. 101.

This insect has a singular appearance. Its flattened foliaceous head shows a tendency to expand into the remarkable forms exhibited by the lantern-flies.

Head somewhat pentagonal, flat, leaf-like, and as wide as the pronotum. Eyes small and globular. Ocelli obvious, and placed near the base of the vertex. A depression between each ocellus and oculus. Neck (*naque* of Fieber) short. Pronotum broad, with a rounded foliaceous porrection on each side. Scutellum small and transversely wrinkled. Abdomen ridged in the middle. Somites well marked. Hind tibiæ much flattened in the middle, spotted and ciliated. Frons scutiform. Clypeus and rostral sheath small. Antennæ rise from below tectiform ridges, which arch over the eyes (see fig. 3*f*). Lateral saw-valves broad, with a deep sulcus, showing the backs of the serrated laminæ within. Valves of the male pygofer smaller and more ovate than the female.

The general colour of the live insect is greenish gold passing into brown. Elytron with a yellower tinge on the disc. A broad black triangular spot occurs on the costa, a smaller one nearer the apex, and yet another on the lower margin. Wings with a brownish membrane and darker veinings. Under-side uniformly pale fulvous-yellow.

Cabinet specimens soon lose their bright colouring. My figure, though taken from a fine specimen, is printed of too bright a green. The profile shows the head and prosternum flattened almost like a scale; in short, the whole insect has the appearance as if it had been pressed under a weight.

Burmeister and Curtis give excellent coloured drawings of this insect, which is by no means common in Britain. I received, however, eight specimens in one summer from Brockenhurst, in Hampshire.

Size expanded, 1·31 × 1·04 inches, or 32·0 × 26 millimètres.

ULOPIDÆ.

Genus XVIII.—ULOPA, *Fall.*

Legs very short and destitute of spines. All the tibiæ prismatic. Elytra with nervures strongly raised. Head tumid.

Ulopa reticulata, *Fab.* Plate XXVI., figs. 2 to 2*g*.

Cercopis reticulata, Fab.
,, *cricæ*, Germ.
Ulopa obtecta, Fall.; Germ.; Burm.; Flor; Marsh.; Kirschb.; Scott.
Ulopa cricetorum, St. Farg. et Serv.
,, *macroptera*, Kirschb.
,, *reticulata*, Sahl.; Edw. pt. i. p. 102.

Head broader than the pronotum. Vertex swollen, with a depression on each side of the medial line. Eyes large and reddish. Antennæ rising from deep fossæ close to the frons. Pronotum with "a horse-shoe shaped depression on each side" (Edwards). Scutellum triangular, with two brown marks on the upper border and another below, traversed by a streak giving to this part of the thorax somewhat the appearance of a mask. Elytra short, oval, and pointed at their apices. Neuration very coarse, and much raised or embossed above the membrane, which last is thickly punctured with round dots. The suture to the clavus is imperceptible.

The general colour is warm greyish, with rich umber or brown-sienna marks. A whitish streak passes from the vertex through the thorax to the cauda. Body very punctate.

I am not sure whether the insects, which are not uncommon at the roots of *Erica* and *Calluna* on the heaths around Haslemere, are to be regarded as Brachelytrous or Macropterous forms. Those I have examined have elytra considerably longer than the body, but I cannot discover in them any true wings. Mr. Edwards describes the Macropterous form, "Pronotum wider and more convex behind. . . . Claval suture distinct. . . . White bands obsolete."

Fieber gives an etching of the true wing, which I have copied, but his manuscript wanted the diagnosis of the species. Sahlberg says, "Tegminibus postice porrectis. . . . Alis explicatis," whilst for the Brachypterous form he says "Alis nullis." I conclude, therefore, that my figures relate to this last form.

This insect is sluggish in habit, usually attaching itself strongly to a furze spicule or to a rootlet of a plant, and feigning death when it drops to the ground. It is very tenacious of life, and will live for more than a week in a pill-box without food or extra moisture.

Size, 3·0 to 3·5 millimètres, or 0·14×0·06 inch.

N.B.—The curious mask-like mark of the scutellum before noted is very constant and persistent through many genera and species of Tettigidæ. It appears very markedly in the Deltocephalidæ and the Typhlocibidæ, and in many examples they represent successfully the "death's head and cross-bones" so clearly seen in our great Sphinx-moth, *Acherontia atropos*.

Scott calls *Ulopa obtecta* (*reticulata*) the commonest of the common amongst species; he says that they lie largely all the summer at the roots of heath, whilst in winter they keep themselves together amongst the decayed flowers and seed-pods. They so much resemble these last objects that until the insects move they may readily be mistaken and overlooked.

Ulopa trivia.

Ulopa trivia, Germ.; Burm.; Kirschb.; Scott; Edw. i. p. 102.

Smaller than *U. reticulata*. Male ochreous, with greyish elytra. The male has a broad squarish vertex or crown, angular near the insertion of the eyes. Two wavy broad brown streaks on the crown, and two fainter stains on the pronotum. Eyes brown. A darkish brown stripe and two paler stripes pass down each elytron, which is grey. Legs short, yellowish, and each with a brown streak.

The female is larger and much paler than the male, which has a vertex almost semicircular instead of square. Scutellum ochreous. Whole insect deeply punctured.

Scarce. Examples have been taken by Dr. Capron near Guildford, and Mr. Dale at Lulworth, on long grass. My description is from insects in Mr. Douglas's collection.

	Inch.	Millimetres.
Size of male	0·10	2·54
,, of female	0·15	3·80

PAROPIDÆ.

Genus XIX.—MEGOPHTHALMUS, *Curt.*

Head flat, forming a narrow lunule; edge acutely margined. Ocelli facial. Tibiæ with a few external spines; hind tibiæ quadrangular, prismatic.

Represented in Britain by the single species figured by Curtis, Ent. Mag. i. 174, 1832, Plate II., fig. 3.

MEGOPHTHALMUS SCANICUS, *Fallen*.
Plate XXVI., figs. 1 to 1 *c*.

Cicada scanica, Fall. *Ulopa scanica*, Fall.
Cælidia scutata, Germ.
Paropia scutata, Burm.
,, *pallidipennis*, Hardy.
,, *scanica*, Kirschb.; Sahl.
Megophthalmus scanicus, Marsh.; Edw. pt i. p. 103.
,, *bipunctatus*, Curt.

Vertex narrow, obtusely angular in front. Pronotum pentagonal; the anterior border forms an obtuse angle, whilst the posterior border is slightly curved at its union with the scutellum. Frons with a feeble middle carination, and with two strong depressions towards the lower half, divided by a channel. Frons hexagonal. Clavus with two nervures and a distinct suture. Elytra membranous, punctured, non-limbated, and provided with strong nervures, which form five apical cells, three ante-apical, and one discoidal cell. Rostrum reaches to the second coxæ. Basal tarsal joint rather shorter than the last joint. Ocelli placed on the angle of each frontal fork.

Whole insect deeply punctured; general colour of a tawny yellow. Eyes red and projecting beyond the width of the pronotum, which last in the male is of a shining black, with a white posterior edge.

Sahlberg describes the male as having no genital valve, and as being considerably smaller than the female.

Occasionally taken at Haslemere; at Shiere, near Guildford; and at Ash, near Bristol.

	Inches.	Millimètres.
Size, male	0·11×0·05	2·79×1·27
,, female	0·16×0·06	4·06×1·57

This insect may be at once separated from *Ulopa* by the different forms of the head and pronotum, and likewise by a variation of the nervures on the elytron.

BYTHOSCOPIDÆ, *Kirschb.*

BYTHOSCOPINA, *Fieb.* BYTHOSCOPIDES, *Sahl.*

From βυθός, deep, and σκοπέω. "Deep-seer" does not seem clear as to its application to these insects.

Body elongated, blunt forward. Ocelli placed on the prone part of the frons near to the vertical margin. Frons dilated. Elytra furnished with long radial veins, joined by transverse and forked nervures. Fore tibiæ without spines. Hind tibiæ spined on the outer side, and fringed on the inner.

No appreciable differences are obvious in Fieber's outlines of the elytra of the genera *Bythoscopus*, *Pediopsis*, and *Agallia*. As a rule the elytra have three discoidal and six apical cells. The presence of a limbus is not a good distinctive character in this group. *Macropsis* shows a feeble representation of one. *Bythoscopus* may be said to be without this "appendix," whilst some species of *Pediopsis* have it, and some have it not. The five genera may be approximately grouped thus :—

N.B. — In *Idiocerus* the head is wider than the shoulders at the bases of the elytra. The sign + means affirmative.	*Macropsis.*	*Bythoscopus.*	*Pediopsis.*	*Idiocerus.*	*Agallia.*
Antenna in a deep cavity . .	+	+	+	−	−
Antenna in a shallow cavity.	−	−	−	+	+
Pronotum transversely striated	+	+	−	−	−
Pronotum obliquely striated.	−	−	+	+	+
Elytron with a limbus . .	−	−	+	+	−

Genus XX.—MACROPSIS, *H.-Schäff.*

Crown with the eyes not wider than the pronotum. Antenna in a deep cavity. Pronotum horizontally striated. Elytra with a thickened apical border, and no true limbus. Punctured with fine black dots.

From Μακρός and σκοπέω, "Big-face."

Macropsis microcephala, *H.-Schäff.* Plate XXVII., fig. 1.

Bythoscopus microcephala, H.-S., Faun. Germ. 164, 8.
Batracomorphus irroratus, Lewis, Trans. Ent. Soc. Lond. i. 51, pl. 7, fig. 5.
Jassus punctulatus, Kirschb.
Macropsis punctuosus, Kirschb.
,, *microcephala*, Fieb., Eur. Bythosc.; Scott; Edw. pt. i. p. 104.

Pale bluish green. Pronotum and elytra darkly and finely punctured. Vertex short, but more acute at the front than in the next described species. Scutellum triangular. Hind tibiæ fringed with stiff green spines.

This insect seems to be rare. It affects Rock Cistus, *Helianthemum vulgare*, on Mickleham Down, Surrey. My figure is from an example taken in the Isle of Wight.

Length, 4 to 5 millimètres, or 0·15 to 0·20 inch.

Macropsis lanio, *Linn.* Plate XXVII., fig. 2 to 2*c*.

Cicada lanio, Linn.
Jassus lanio, Fab.; Germ.; Fall.
Bythoscopus lanio, Burm.
Cicada brunnea, Fab.
Jassus brunneus, Fab.
Macropsis lanio, Am. et. Serv.; Flor; Marsh.; Kirschb.; Fieb., E. Bythos. 450, 3; Sahl.; Scott; Edw. pt. i. p. 105.

Large. General colour of the live insect a fine green, which fades subsequently in cabinets to brownish green. A feeble ridge on the sides of the pronotum, which has marked striæ ranged horizontally with no central ridge. Post-scutellum large. Elytra greenish, with brighter green nervures. Apical border thickened, and the lower claval border also strengthened. Legs bright green. Tarsi ending with rounded pads. The neuration in both elytron and wing is liable to considerable variation in its details. Some specimens thus differ one side from the other. Navicular valve of the female large above the saw-case. Anal opening oval. Under-side greenish brown.

Common on oaks at Haslemere. July and August.

	Inch.	Millimètres.
Expanse	0·36	9·14
Length of body	0·17	4·24

N.B.—The fine hairs on the inner side of the hind tibiæ have been by error omitted in my plate.

Genus XXI.—BYTHOSCOPUS, *Germ.*

Two radial nervures enclose a rhombic basal cell, from the apex of which another radial nervure springs. This by furcation forms two discoidal, three sub-apical and five apical cells to the elytron. Frons convex. Ocelli below the edge of the vertex on the upper part above the frons.

The characters of *Bythoscopus*, perhaps, are hardly sufficiently distinct for a generic separation from *Macropsis;* but I prefer to follow Fieber and others, to avoid a further confusion in the synonyms.

PLATE XXI.

CHLORIONA FARINOSA. (Page 75.)

Fig. 1.—Macropterous form.

Fig. 1 *a*.—Profile view of the same.

Fig. 1 *b*.—Under side showing the apical mealy patches under the tail.

Fig. 1 *c*. — Under side of the head of another specimen, with frons, clypeus, and rostrum.

Fig. 1 *d*.—Elytron of *Chloriona*.

Fig. 1 *e*.—Wing of *Chloriona*.

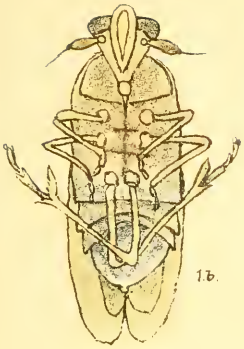
Fig. 2.—Head and frons of a larval form called *Acrotile* by Fieber (see Plate XX., fig. 2). *l*. Labrum.

Fig. 2 *a*.—Same parts showing the facial "pustules," *t*, enlarged from Fieber's outline.

Fig. 3.—Genitalia of the male of *Stiroma straminea*. *e*. Caudal process. *s*. Styles. *p*. Supplemental hook.

Fig. 3 *a*.—Front, but inverted, view of the same male parts.

Fig. 4. — Pygofer of the female of *Stiroma nigrolineata*, showing *e*, cauda, and *o*, part of the saw-valve.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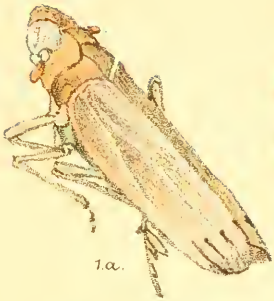
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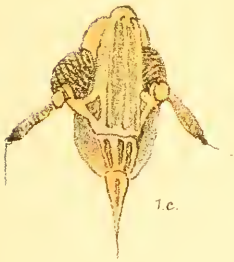
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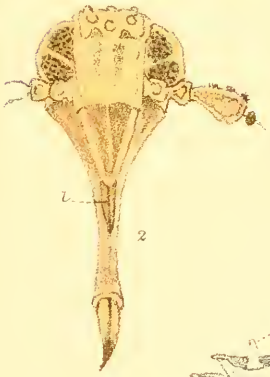

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4

3

3.a

1.d.

1.e.

PLATE XXII.

Triecphora vulnerata. (Page 80.)

Fig. 1.—Imago with spread wings.
Fig. 1 *a*.—The same with wings closed.
Fig. 1 *b*.—Front view of the head, showing the insertion of the antennæ under the vertical ridge.

Aphrophora alni. (Page 82.)

Fig. 2.—Winged form.
Fig. 2 *a*.—Under side of the head, showing the tumid frons and small clypeus.
Fig. 2 *b*.—Profile view of the pygofer.
Fig. 2 *c*. — Part of an elytral cell with its punctuation, much enlarged.
Fig. 2 *d*. — Part of the tibia, showing the three joints of the tarsus with their spines and hairs.
Fig. 2 *e*.—End of the hind foot, with the claws and pulvilli (?)

N.B.—The pink spots on the wings were intended to show iridescence only.

1

1.b.

1.a

2.a

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2.b

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2.e.

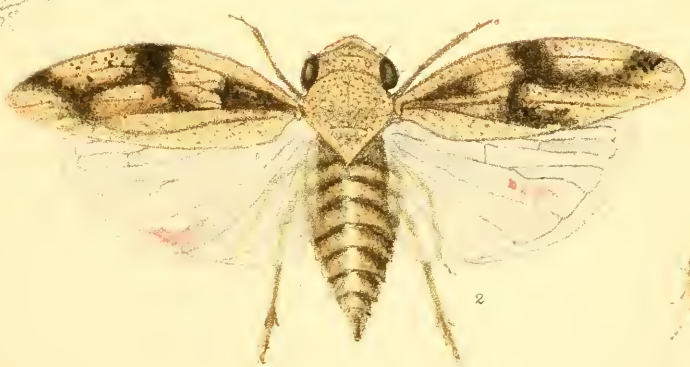

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PLATE XXIII.

Aphrophora salicis. (Page 83.)

Fig. 1.—Imago.

Fig. 1 *a*.—Under-side of the abdomen of the larva.

Fig. 1 *b*.—The larva divested of its concealing froth.

Fig. 1 *c*.—The pupa of the same.

Fig. 2. — Pygofer of the male of *Aphrophora alni*, with the prehensile hooks, &c., much magnified.

Fig. 2 *a*.—The saw of the female with its valves dissected out.

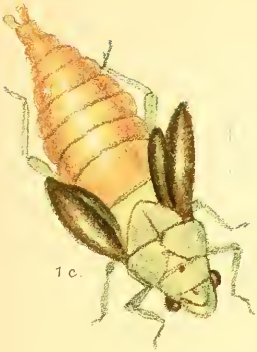
Fig. 2 *b*.—A mass of spume which has dried into a reticulated ball, within which the skin of the dead pupa is seen. The insect probably has been killed by a parasite.

Philænus lineatus. (Page 87.)

Fig. 3.—The winged form. The costal edge is often much whiter.

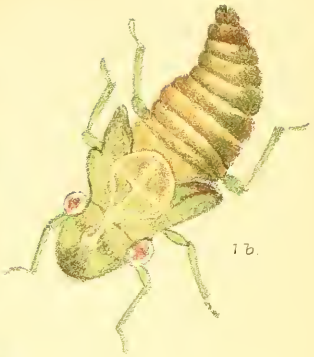
Philænus campestris. (Page 88.)

Fig. 4. — The imago. The natural sizes of these insects are indicated.



1c.

1a.



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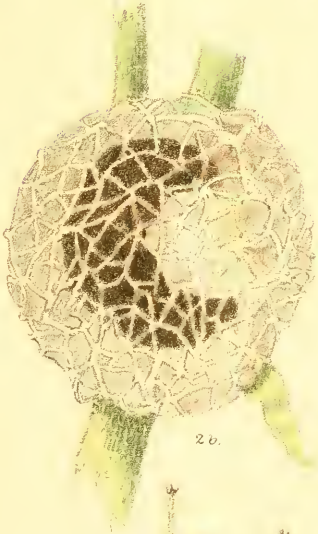

2b.

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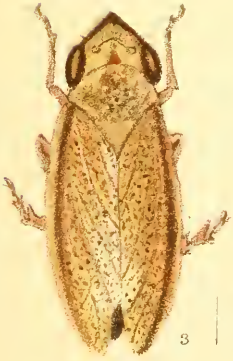

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G.B.B. del et lith.

West, Newman chromo.

PLATE XXIV.

PHILÆNUS SPUMARIUS. (Page 84.)

Fig. 1.—The imago, showing the hind legs with the whorls of spines. Var. *P. populi.*

Fig. 1 *a.*—The pupa, with bubbles of air blown from the anus of the insect.

Fig. 1 *b.*—A mass of foam with the larva of *Philænus* crawling from it.

Fig. 1 *c.*—Antenna of the larva, showing the compound nature of the seta.

Fig. 1 *d.*—Leg of larva, showing the undeveloped nature of the tarsus.

Fig. 1 *e.*—Double claw and bristles of the foot.

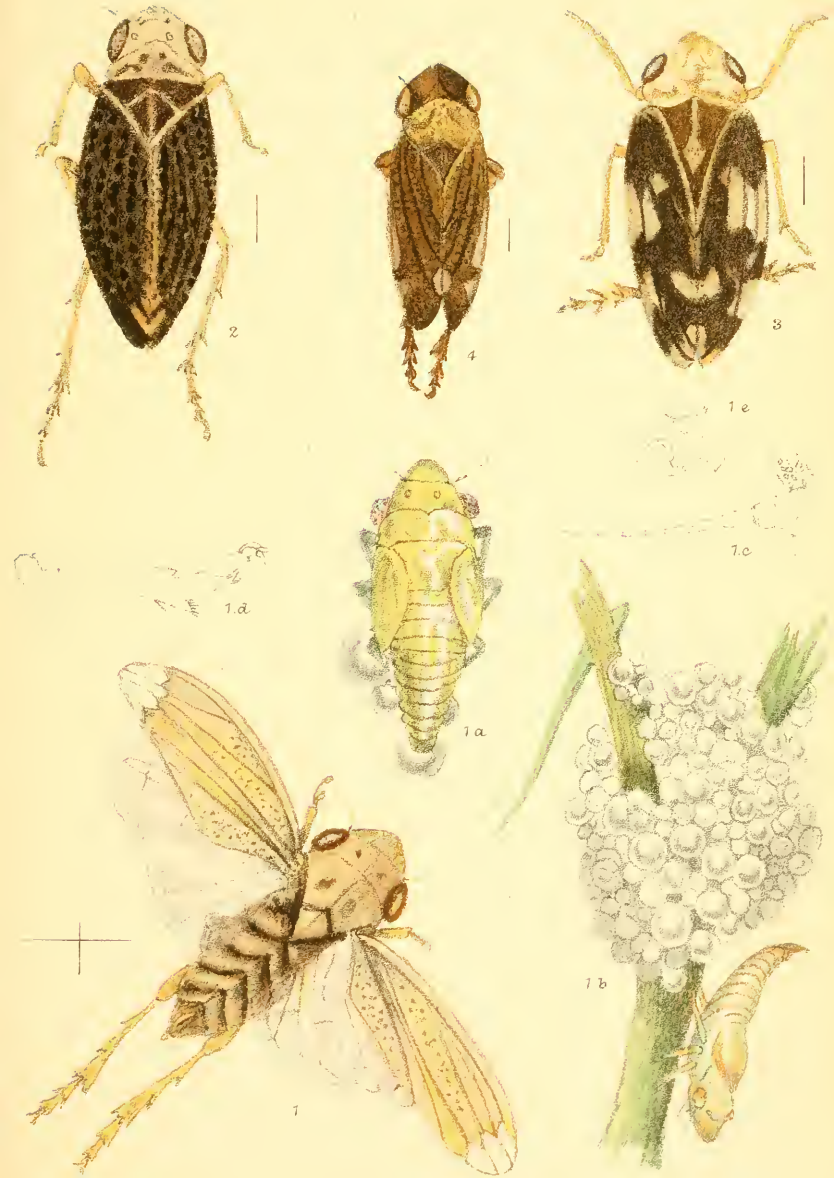
PHILÆNUS SPUMARIUS. Pages 86 and 87.

Fig. 2.—Variety known as *P. leucocephalus.*

Fig. 3.—Variety known as *P. fasciatus.*

PHILÆNUS EXCLAMATIONIS. (Page 87.)

Fig. 4.—Imago. This is the smallest of the British Cercopidæ.



G.B.B del et lith

West Newman chromo

PLATE XXV.

LEDRA AURITA. (Page 89.)

Fig. 1.—Winged male, showing the leaf-like appendages to the pronotum.

Fig. 2. — Head, neck, and part of the pronotum, more magnified. The ocelli are shown, and the tuberculated surface of the vertex.

Fig. 3. — Under-side of the head. *b*. Clypeus. *c*. Lower part of the frons. *d*. Gula. *f*. Antenna springing from a tubercle under the ridge of the frons. After Burmeister.

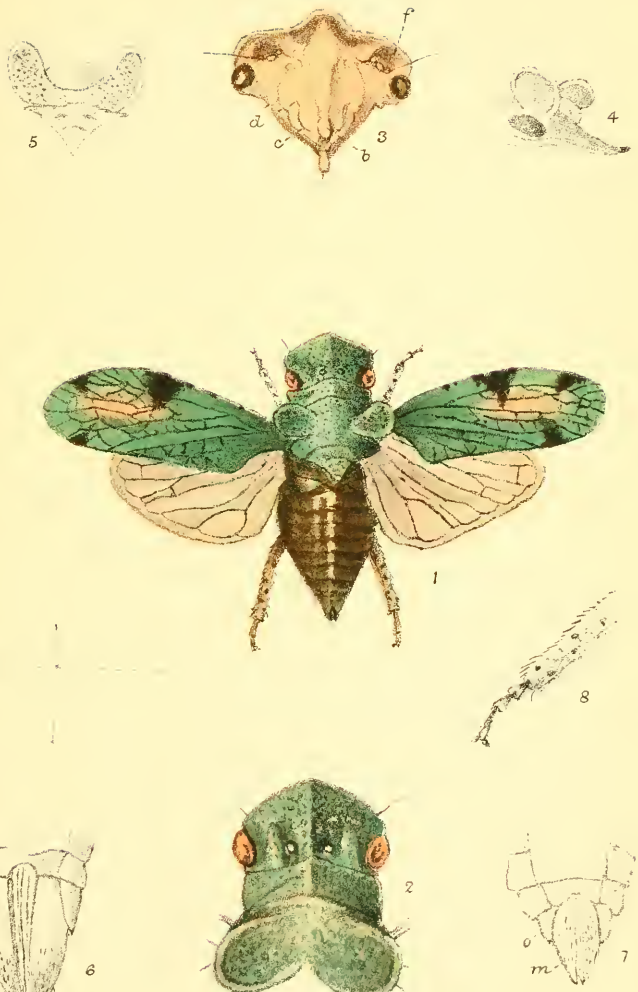
Fig. 4.—Profile view of the upper part of the pronotum.

Fig. 5.—Pronotum seen from behind, with part of the scutellum.

Fig. 6.—Under-side of the female pygofer. *q*. Lateral plate. *n*. Groove for the saws.

Fig. 7.—Similar parts of the male insect. *m*. Valve. *o*. Basal plate.

Fig. 8.—Part of hind tibia and tarsal joints.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q
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m

PLATE XXVI.

Megophthalmus scanicus. (Page 93.)

Fig. 1. — Male, showing the angular vertex and punctured elytra.

Fig. 1 *a*.—Female, relatively of the same size. The mask-marked scutellum mentioned in the text is apparent in this and the following genus.

Fig. 1 *b*. — Female insect seen in profile. The swollen frons is to be noted, and also the projecting pronotum.

Fig. 1 *c*.—Head and pronotum enlarged.

Ulopa reticulata. (Page 90.)

Fig. 2.—Imago, or winged form, showing its tumid and broad head.

Fig. 2 *a*.—Head and frons of the same, showing the fossæ or pits from which the antennæ take their rise.

Fig. 2 *b*. — Elytron and wing of the same. The nervures of the former are thick and raised.

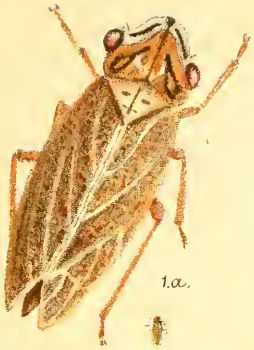
Fig. 2 *c*.—Part of the male pygofer from the dorsal aspect.

Fig. 2 *d*.—Part of the female pygofer, with its anal process, rising from the anal tube. Part of the saw-case is visible on the lower side of the insect.

Fig. 2 *e*. — Part of the tibia and tarsus much enlarged. The three tarsal joints show a tendency to twist one over the other. The final joint has rounded ends and very minute claws.

Fig. 2 *f*. — Under-side of the male pygofer, showing the navicular plate and two pilose plates of the genitalia.

Fig. 2 *g*. — The antenna much magnified.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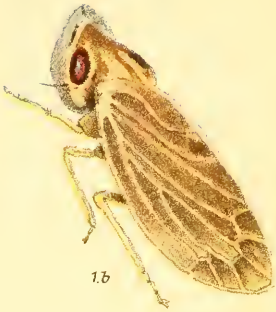
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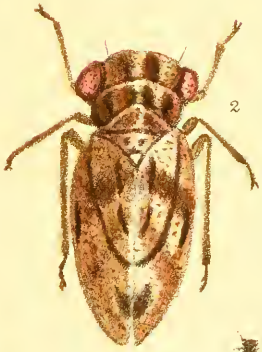
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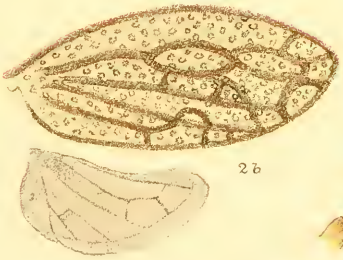
2.f

1.c.

2.a.

2.c.


2.b

2.d

2.e

PLATE XXVII.

Macropsis microcephala. (Page 95.)

Fig. 1. — Winged form enlarged, and also of the natural size.

Macropsis lanio. (Page 95.)

Fig. 2.—Female form, showing the horizontal striations on the pronotum.

Fig. 2 *a*.—The same with expanded wings.

Fig. 2 *b*.—Head, showing the frons and clypeus.

Fig. 2 *c*.—The front view of the head, showing the overhanging vertex and the insertions of the antennæ.

Fig. 2 *d*.—The elytron and wing. The former is inconstant as to the number of apical cells.

Fig. 2 *e*.—Part of the saw (*s*), the outer sheaths (*h*), and the lower plate at *k*.

N.B.—Although it has been shown by the details on many plates of this Monograph that all the Tettigidæ are, as to their tarsi, trimerous, it has not been easy so to show them on the representations of the coloured complete insects. It happens in many cases, that unless the foot be viewed in profile and with a deep lens, on account of the mergence of joints, the insect may appear under the camera lucida to have only two, instead of three, tarsal joints. Therefore in all cases of detail of wing-veining, or of antennal or pedal significance, the highest authority must be given to such details, for as a rule distortions will not here occur through perspective, or the errors liable to stone colouring be so marked. Details for tarsi may be seen in almost all of my former plates.

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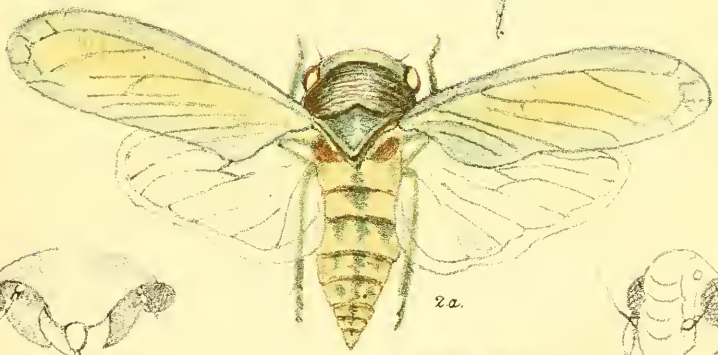
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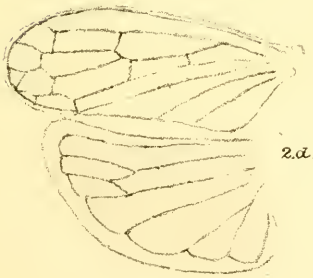
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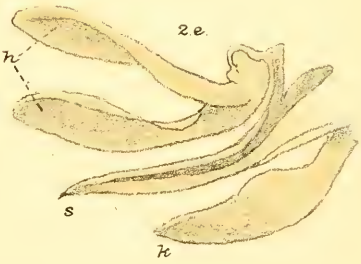
2 e.
h
s
h

PLATE XXVIII.

Bythoscopus alni. (Page 97.)

Fig. 1.—Female with closed elytron.
Fig. 1 *a*.—Male variety of the same, with brighter colouring.
Fig. 1 *b*.—Frons, clypeus, and rostrum of the same.
Fig. 1 *c*.—Similar parts seen in profile. The face is somewhat convex.
Fig. 1 *d*.—Part of the tibia with its serratures and the three-jointed tarsus.

Bythoscopus rufusculus. (Page 98.)

Fig. 2.—Female with expanded wings. The striations are horizontal on the pronotum.
Fig. 2 *a*.—A redder female variety.
Fig. 2 *b*.—Front view of the head with the ocelli.
Fig. 2 *c*.—Part of the tri-prismatic tibia.

Bythoscopus flavicollis. (Page 98.)

Fig. 3.—Side view of the female insect.
Fig. 3 *a*.—Pygofer of the same, showing the saw lying between the valves.

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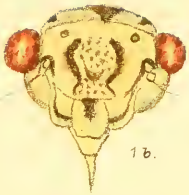
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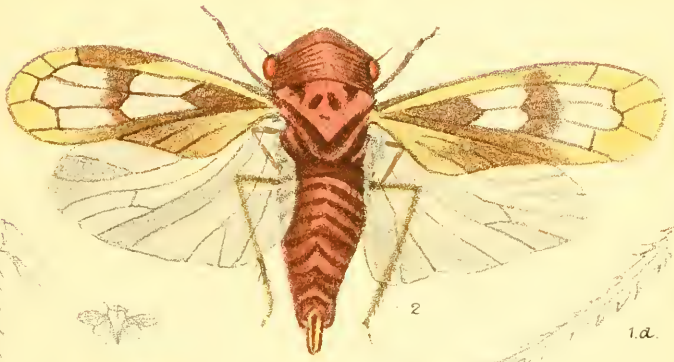
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2 c.

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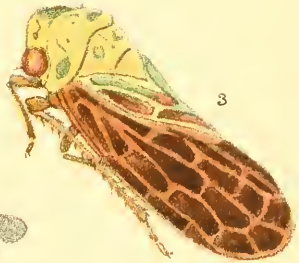
3 a.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2 b.

PLATE XXIX.

PEDIOPSIS VIRESCENS. (Page 100.)

Fig. 1.—Winged female.
Fig. 1 *a*.—Under-side of the pygofer of the same.

PEDIOPSIS IMPURUS. (Page 101.)

Fig. 2.—Male insect.
Fig. 2 *a*.—Female of the same, which is much larger.
Fig. 2 *b*.—Front view of the head and fore legs.

PEDIOPSIS NANUS. (Page 102.)

Fig. 3.—Winged insect, showing the oblique striations on the pronotum.

PEDIOPSIS FUSCINERVIS. (Page 102.)

Fig. 4. — Female insect. The curious mask-like markings on the scutellum of this and the former insects are well pronounced.

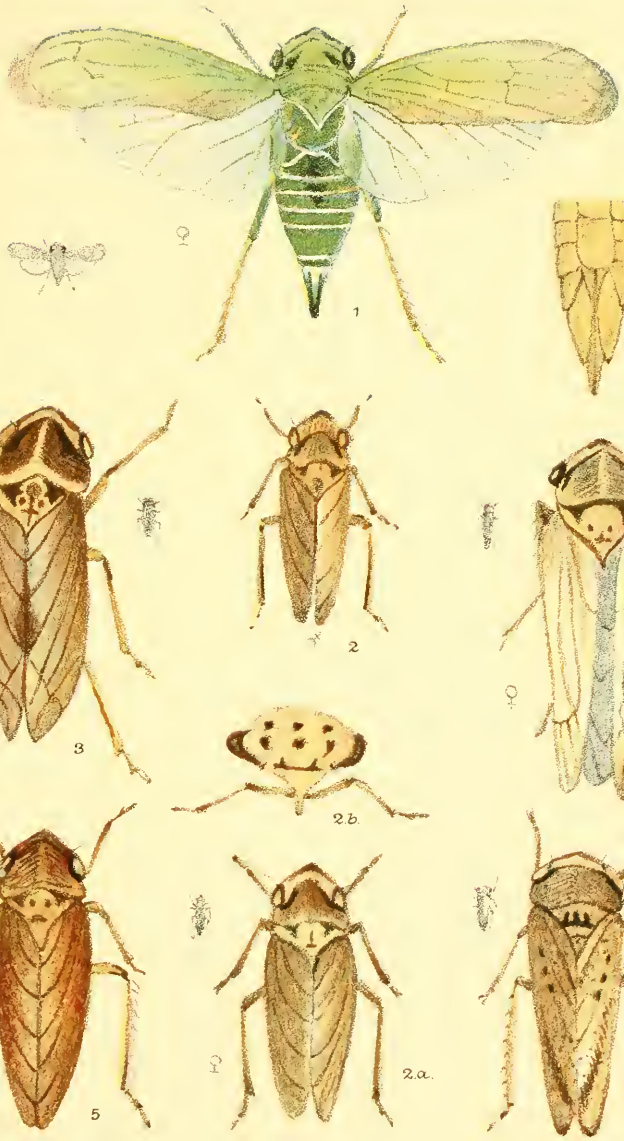
PEDIOPSIS ULMI. (Page 103.)

Fig. 5. — Female imago. The black dash on the hind tibiæ may be noted.

PEDIOPSIS TILIÆ. (Page 103.)

Fig. 6. — Imago. The natural sizes of all these insects are represented.

PLATE XXIX.



G.B.B. del. et lith

West, Newman imp.

PLATE XXX.

PEDIOPSIS CERIUS. (Page 104.)

Fig. 1.—Imago of the female. The elytron has no limbus or terminal border,

Fig. 1 *a*.—Male of the same, of relative size.

PEDIOPSIS NASATUS. (Page 104.)

Fig. 2.—Imago enlarged and also of the natural size.

Fig. 2 *a*.—Head, with frons and the fore legs.

PEDIOPSIS SCUTELLATUS. (Page 105.)

Fig. 3. — Imago showing its pointed and spotted vertex.

Fig. 3 *a*.—Vertex, pronotum, and hairy scutellum.

PEDIOPSIS TIBIALIS. (Page 105.)

Fig. 4. — Imago. The inconstant number of the apical cells in this specimen may be noted, and also the presence of a slight limbus to the elytron.

Fig. 4 *a*.—The same insect with closed wings.

G B B del. et lith

West, Newman chromo

MONOGRAPH

OF THE

BRITISH CICADÆ

(Froghoppers and Grassflies).

By GEORGE BOWDLER BUCKTON, F.R.S., &c.

The comparison of specimen with specimen is the basis of all zoological and biological research. Doubtless, after living forms, collation with museum specimens is of the greatest use to the investigator. Such specimens, however, are not open to the use of many, and to those who have no access to them, monographs are of prime importance.

It will be admitted that every enlightened and civilised country ought to concern itself with the description of its Fauna and Flora. Quite apart from an economic point of view, it is incumbent on us to help forward the progress of knowledge, and to accumulate materials for comparing present living forms with those varieties which may proceed from them in future years; and these materials will assist in the elucidation of some of the far-reaching developmental problems under discussion at the present time.

No coloured monograph of the British Cicadæ exists, and it is even believed that no adequately illustrated monograph exists of European species. Partly to meet this want, it is proposed to publish eight quarterly Parts, each containing on an average ten litho-chromo plates and letterpress, illustrating the forms, metamorphoses, general anatomy, and the chief details connected with the life-history of this family of insects.

The work will contain also short diagnoses of all the British species, about 230 in number, most of which have come under the author's notice, each species being illustrated by one or more coloured drawings. Some account will be given of the curious myths and tales told by ancient Greek and Latin poets, and descriptions will be appended relating to the curious sound-organs possessed by some species, and other subjects connected with the economy of this interesting but difficult group of Rhynchotous insects.

It is believed that by the help of the numerous camera-lucida drawings, which will appear in this Monograph, many of which have been made from type specimens in the cabinets of Mr. J. W. Douglas and Mr. James Edwards, the identification of nearly-allied species will be facilitated.

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October, 1890.] [In Eight Parts.—Part IV.

MONOGRAPH

OF THE

BRITISH CICADÆ,

OR

TETTIGIDÆ,

ILLUSTRATED BY MORE THAN

Four Hundred Coloured Drawings.

BY

GEORGE BOWDLER BUCKTON, F.R.S., &c.,

COR. MEMB. ACAD. NAT. HIST. OF PHILADELPHIA,

MEMB. DE LA SOC. ENT. DE FRANCE.

"Sole sub ardenti resonent arbusta Cicadis."

"The small becomes the dreadful and immense."

London

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ABBREVIATED TITLES OF THE WORKS OF AUTHORS

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The Abdomen.

This part of the insect occurs cylindrical, fusiform, flattened, roundly truncate, or nearly square. It is usually composed of seven, or sometimes of eight, horny rings, joined by the interposing connexivum or pliable membrane. Usually one more ring can be counted on the dorsal aspect than on the ventral; but at the extremity of the abdomen a kind of case or envelope occurs, which in the females contains a complicated apparatus of saws and files, and in the males an equally elaborated series of prehensile hooks, suited to secure the couplement of the sexes at the fitting season. The typical number of segments in insects is generally recognised as thirteen, but in many cases two or more rings become united into one, and thus the visible number is inconstant.

As the female carries her partner, the claspers are at such times very efficient during the performance of their vigorous leaps from bush to bush. The envelope above alluded to is called the "pygophore" by Fieber, which, with its valves and styles, will be described elsewhere, and may be seen drawn in many plates.

In *Cicadetta* the basal abdominal rings are covered by the semilunar plates, which protect the sounding cavities with their tense tympana. On the ventral aspect six stomata with fringed entrances may be counted on each side; they are placed on the edges of the connexivum, but they are not always visible. The abdomen can be thrown into longitudinal folds, whereby its shape may become either cylindrical or flattish. The viscera in the winged insects are mostly very attenuated, and often seen to be nearly void of nutritive matter.

The Legs.

In the Tettigidæ leaping is chiefly effected by the legs, but considerable assistance is also given by use of the wings.

The limbs are specially adapted for this mixed motion, being furnished with strong spurs and rows of fine setæ, which take a hold on any roughness which presents itself as a "point d'appui."

Powerful muscles are required to work the legs, and therefore the femora and coxæ are robust. The tibiæ are very long, and to these are attached the greater number of spines and hairs. Most markedly this is so on the third pair of legs. In the Cercopidæ we find two or more coronets of spurs on the tibiæ and tarsi. In the Delphacidæ, a characteristic tibial serrated plate is seen near the tarsus, which plate is well-fringed with prehensile setæ.

To enable the insects to carry their legs easily, the femora are long enough to project beyond the insertions of the elytra; and thus the tibiæ fold back, and do not extend much beyond the apex of the abdomen. The femora also are curved and flattened, so as to lie parallel to the tibiæ, and this is always the position assumed by the insect before taking a leap. The knees being placed well forward, and then suddenly extended, the spines become engaged with the pilose coats of the grasses, &c., and the leap is effected.

If a flea can leap two hundred times its own length, a man, in proportion to his size, could jump higher than any building yet constructed. Many small Tettigidæ make more surprising leaps, but the larger kinds progress chiefly by short flights. The two front pairs of legs are used also for running backwards, forwards, and sideways. This last action seems to be peculiar to the Tettigidæ, and their odd crab-like movements might almost suggest a possible example of atavism to that articulate class.

The tarsi are composed of three joints, the last of which ends rather abruptly. The claws are minute, curved, and sometimes accompanied by pulvilli.

The number of tarsal joints has always been considered of great importance in insect classification; yet,

as an example of the difficulties to be met with in forming a natural system, amongst the Coleoptera, it sometimes happens, that the tarsal joints differ in the two sexes, and some Tettigidæ do not show their trimerous characters in the fore legs.

The Elytra. Oberflügel.

On account of their semi-coriaceous texture, the upper alæ are called Elytra, and the lower organs alone are styled Wings.

A slightly modified nomenclature is used in this treatise with reference to the wing-cells. It is chiefly that adopted by Sahlberg, which appears to be more simple than that constructed by Fieber and some others. In the Cicadidæ and the Membracidæ, the radial veins undergo many furcations, from which arise a multiplicity of cells and reticulations; but as we pass to the Jassidæ, and to still simpler genera, the radial veins become restricted to three, or perhaps only to two, main branchings, as exemplified in *Dicraneura*, &c.

The neuration of the elytra is often difficult to trace, on account of the tendency of the membrane to become horny; the nerves or veins then fuse together, and are lost in the substance of the wing.

The elytra start from strong scale-like processes articulated to the mesonotum (tegulæ). They are mainly supported by a robust costal vein, which, as a rule, gives off no stout branches to other veins, but anastomoses with them by short transverse veins. The elytron is divided longitudinally by a straight suture into the corium and the clavus, which last is usually restricted to two unbranched veins. The corium forms the largest part of the organ, and in many species is bounded by a characteristic free border, known as the limbus, periphery, or appendix. The clavus forms the efficient fold which overlaps the margin of the flying apparatus, to the secure closure of which the limbus also conduces.

The corium is mostly bordered by the above-named limbus, the absence of which may be used for a generic character, as in *Cixius* and in *Issus*. At the point where the limbus ends, the clavus may be taken to begin. The corium has a *normal* number of five radial veins; these are set forth by those nervures which proceed directly from the tegulæ to the limbus, where they end without crossing the marginal nerve.

Counting from the limbus, the elytral cells in series may be thus enumerated:—Apical, sub-apical, discoidal, costal, marginal, and basal cells. To these elytral cells, some genera show one or more supplemental cells.

The Wings. Unterflügel.

Venation in these organs is easily traced, except amongst the minute Typhlocybidæ. Occasionally, the texture is in these so delicate and fragile, that some address is requisite to unfold their numerous plications without tearing them and disarranging their order.

Fieber studied much the venation of the genera he described. He chiefly used the elytra for this purpose, whilst Sahlberg turned his attention more particularly to the wings proper. Of these wings Sahlberg engraves twenty or more generic examples.

The wings spring from the metanotum, and, like the elytra, they may be divided into the corium and clavus. The membrane which fills the wing-cells is exceedingly thin, and is often iridescent, whilst the membrane of the elytra is rarely so, but, on the contrary, often pilose, pitted, or dense.

Nomenclature of the wing-neuration (or venation of others) will be found in the descriptions of Plates A and B, where also the veining is delineated.

In further explanation of Plate A, fig. 12, the letters have the following references:—*i* and *j*. Open cells of the clavus. *r*. Anal wing-cell. *o*. Sutural wing-cell. *s*, *t*, *u*. Subapical wing-cells.

The Pygophore and Pygothèque.

The number of abdominal rings in the Cicadinæ is not easy to decide, on account of the union of several somites to form the pygophore. This last is a complex apparatus, forming a kind of box for enclosing the saws and rasps of the female, and the claspers and the penis of the male. Prof. C. Riley, the indefatigable American entomologist, says that the male apparatus is so effective as a clasper in *Cicada septendecem*, that when the insects are caught *in coitû* they fail to disengage themselves immediately, and then one or the other usually leaves the last abdominal segments behind it. Such insects will live some days after this extensive mutilation, flying about freely; but singularly, he observes, they then are liable to the attack of a kind of fungus, which converts the internal organs into a dry powder, apparently composed of fungoid spores.

A similar mutilation of the honey-bee is well known, in which the sting is mostly lost with the terminal rings, from the failure in the excited insect to retract its barbed lancets.

The pygophore encloses the anal aperture (*afterfuteral*), and the anal pieces, which in the Delphacidæ are grouped within a circle. At the superior border of this circle, and in the medial line, is placed the anal tube (*aftersteilchen*), which has various forms and lengths, and often has lobes or hooks at its base (*vide* Plate XVIII., fig. 2 *a*, and Plate XIX., fig. 2 *c*). At the inferior part of the pygophore we find, amongst the Delphacidæ, two free styles attached at their bases. Mr. J. Scott employed these last appendages as helps to discriminate several nearly allied species. The pygophore of the male shows in profile the *porte-penis* and the styles, with its hooks and filaments disposed on each side (*vide* Plates A, V., VI., VII, XIX., XXI., &c.).

Amongst the Jassidæ, the pygothèque occurs below the pygophore, and is composed of two walls, " parois

ouvertes en dessous et en arrière vers le haut," united at their half or at their base. It carries the cauda or anal style.

According to Fieber, the penis lies hid between these walls. Two plates take their rise below the pygophore, and at their internal bases, a variously-formed style occurs. The plates close the entrance of the pygophore, and their base also is closed, outwardly and below, by an undivided valve. In *Cicadetta* the pygophore takes somewhat the form of a casque or helmet, seen sideways.

The pygophore of the female has a peculiar structure, being composed of a longish sheath, furnished with a groove of two valves, within which lie the before-mentioned serrated saws. The anal tube is placed at the end of the colesteron, and has its cauda within, whilst the navicular valve is seen at the end of the vaginal sheath. Fieber calls the plates on each side of the interior border of the ventral segments, "lateral plates" (*neben-platten*), but Sahlberg names these "lateral lobes." A better idea of these complicated adjuncts may be got from an inspection of Plates XII., XVIII. and XXI. It must be admitted that the functions of these curious parts of the male pygophore are but little understood. Their great diversity, and the wonderful correlation of the male to the female parts cannot be explained on any doctrine either of haphazard, or of *conscious* selection by the separate sexes.

Unfortunately, a destruction of specimens is involved in the demonstration of these parts. Their separation is best effected after soaking for some hours in strong potash solution. This reagent has but little action on chitine, whilst it dissolves the soft parts easily. After sufficient washing in water, the parts may be mounted in Canada balsam for the microscope.

As details will be given on the plates illustrating the various species, no more need here be said; but Fieber's 'Synopse der Europaischen Deltocephali' and

'Grundzüge der Delphacini' may be consulted for the many small etchings relating to these parts; also Mr. Scott's numerous papers in the Ent. Mo. Mag., vols. vii. and viii.

On the Sounding Organs of the Cicada.

Réaumur was the first author who studied the anatomy of this insect with any pretence to accuracy. His observations have been in great part confirmed by those who have come after him.

In Italy, which may be called the home of the European Cicada, Filippo de Filippi early pointed out that on the under side, below the thoracic scales, two cavities are separated by an intermediate corneous septum, and that from these cavities the well-known stridor is produced, inappropriately called the song of the Cicala or Cicada. Afterwards this author pointed out the two membranes which are concerned in the production of the sound.

More recently Prof. Targioni Tozzetti, of Florence, took up this subject, and, still later, Dr. Cesar Lepori, who published some interesting experiments, which seem to put at rest the question how far the stomata have anything to do with the stridulation. After pointing out that Landois had no right to challenge Réaumur's work, "because he never possessed a living insect," since he himself laboured under the very same disadvantage, Prof. Lepori describes the parts concerned, and divides them into essential and accessory organs. He first proceeded to remove, from a living specimen, portions of the semilunar metathoracic scales, little by little, and finally he took the whole of them from above the cavities. Still he found that the Cicala chirped equally well without, as with, these scales, and thus he came to the conclusion that they acted merely as protective coverings to the membranes below them.

Two membranes appear in view, after the removal

of the thoracic opercula. One is glittering and iridescent, the other is thicker and yellowish. Dr. Lipori also cut away these, little by little, and found that, although the sound was modified, it was not extinguished; indeed he thinks that they act principally as means for keeping extraneous matters out of the cavities, and possibly for modifying their resonance.

Through an opening made down the back of the abdomen, the viscera were removed, and this exposed two masses of muscle. Still the insect continued to sing as if nothing had been done to it! "L'animale continua a cantare, come se nulla fosse. Ma se si taglia no le massa muscolari, l'animale non canta piu." If the muscle be cut on one side only, the song can still be continued on the other.

In a similar manner it was proved that the destruction of the corrugated membrane (membrana pieghettata) entirely prevented all action of the stridulous apparatus.

A rapid vibratory movement can be distinguished in these muscles, if viewed under a lens. Réaumur's experiment of evoking the creaking sound, by scratching the drum (tamboure) with a fine needle, was successfully repeated by Dr. Lipori.

Landois urges the importance of certain metathoracic spots (stigmi), which he thinks conduce to the sound. Lipori closed these stigmata with oil, and he states that, although the Cicala was inconvenienced, its singing powers were not much impaired.

Lipori could find no singing parts, even rudimentary, in the females of *Cicada orni*, *C. hæmatodes*, or *Tettigonia plebeia*, of Rossi. Nevertheless this, of course, does not disprove the assertion of certain authors, that the rudiments *do* occur in the females of certain foreign species.

Réaumur, in his 'Mémoire' above cited, objects to the opinion of old authors that the friction of the scales, or, again, the vibrations of "les petits miroirs,"

cause the stridor. He says "Les deux petits miroirs comme deux tambours ne rendoient pas les sons," for "les baguettes," are wanting, besides which the films are too slack to yield sound. Again, "Pendant que je tirallois doucement (le tamboure) avec un epingle, pendant que je le faisois un peu sortir de sa place, pour l'y laisser retourner, ensuite il m'arriva de faire chanter un cigale morte depuis plusieurs mois. Le chant, comme l'imagine, ne fut pas fort."

The rapid quivering of the Cicada's drum, though wonderful, is not really so great as that performed by the gnat whilst vibrating its wing and shrilly piping in its flight.

In a February number of 'Nature'* a diagrammatic drawing, by Mr. C. Lloyd Morgan, may be seen of the sounding organs of a South-African Cicada, which drawing virtually agrees with Prof. Lipari's account of the apparatus. He further makes the interesting remark, that under the stimulus of a weak current of electricity, the singing noise can be sustained for some minutes after the apparent death of the insect.

Mr. C. Middlemiss also states that a Himalayan species likewise produces its screech by a rapid wrinkling of its parchment-like drum.

Thus it is shown that the chirp of the Cicada differs from that of the Grasshopper, and that nothing acting as a plectrum is concerned in the production of the sound. Special muscles act on a tense corrugated membrane, which is rapidly pulled downwards, and as often released. A similar creaking noise may be made by alternately pulling and releasing a string fixed to the centre of a tense paper disc, glued on a metal ring.

Figures illustrating the various parts from Prof. Lipori and Mr. C. L. Morgan will be found reproduced on Plate B of this Monograph.

* 'Nature,' Feb. 18, 1886, p. 368; also "Notes on the Singerjie, the well-known Cicada of the Cape of Good Hope, *Platypleura capensis*," Proc. S. African Phil. Soc. 1879—1880, pt. iii. p. 161.

In addition to the description given of Plate B, fig. 4, *r* represents the posterior translucent tense membrane, and *s'* the part of the outer chitinous support of the abdomen.

I have also dissected specimens of Cicadæ sent to me from the North of Portugal and from Brazil. The results are quite in accordance with those obtained by the recent observers above noted.

The Circulatory System.

As the bodies of insects are well supplied with tracheæ and a plexus of air-tubes, there is no necessity for blood-vessels, properly so called, and therefore they do not exist. Thus, instead of the blood being brought to special organs like gills or lungs, the necessary oxidation is affected simultaneously by air-tubes, and throughout all parts of the body.

The Circulation of alimentary fluid is mainly carried out through the many-chambered dorsal vessel or chain-like heart, which, receiving the chyme transuding through the walls of the intestines, is propelled from the lower end forwards to the head; from whence it is discharged, (as has been shown by Herold,) directly into the cavity of the body, bathing all the organs, and entering even into the joints of the antennæ and the legs. After aëration, this nourishing fluid returns to the posterior end of the dorsal vessel, where, after mixing with fresh lymph, it is restored into the same circle of circulation, through a kind of peristaltic movement of the heart (*vide* Plate C).

The Alimentary System.

As in all Hemiptera, nourishment in the Tettigidæ is drawn through a proboscis, which, united just before the insertion of the salivary ducts, *s s*, is joined to an œsophagus of varying length. According to Burmeister,

the pumping action on plants, set up by these insects, is effected by or through an expansion of this tube, just before it unites with the stomach (*vide* Plate C, fig. 1 *c*). This pouch constitutes the "crop" of some authors. It is developed in all Cicadinæ, but it can be well seen in the larva of *Aphrophora*.

The vegetable juices collected in the crop, pass into the gizzard or pro-ventricle, *v*, where probably they undergo some change, for the inner lining of the sac is often curiously plicated. Thence the juices pass into the first, and finally into the second and much more attenuated, portion of the stomach, *v'*. If present, the biliary vessels generally pour their secretion into this viscus, just below the pylorus or intestinal end of the stomach proper.

In *Aphrophora*, the attenuated part of the stomach returns, by a complete loop, to a place not far from the cardiac entrance, where it then meets with the biliary secretion, from the hepatic ducts, *h*, before it passes into the ilium or colon, and finally to the cœcum or rectum, *r*. The chyme transuding through the walls of these organs becomes free in the abdominal cavity, and thus bathing all parts, it nourishes and invigorates them. All parts seem to be kept in their places by the ramifications of the tracheæ and the adipose tissue.

The whole alimentary tube, from end to end, is composed of three membranes,—the innermost, or that in contact with the food, being thrown into folds, to increase its surface; whilst the outer part is covered with tubercles, which Strauss calls glands, and probably they are such. (Fig. 3, *h*).

Aristotle says that the *Tettix* is cold-blooded, and therefore it requires but little food; hence its simple tongue [and mouth without jaws?], through which it "imbibes nutriment like the root of a tree." The Tettiges he calls an "Atrophous race." ('De Partibus,' viii. 21.)

The Nervous System.

But little can be here said with reference to the intricate network of nerves which can be traced in the bodies of the Cicadæ.

Concisely, it may be said that the cephalic ganglion is bilobed, and that each lobe sends off one branch to the eye, and another smaller branch to the ocellus. Each antenna also is similarly furnished, though the filament is minute. Posterior to the cephalic lobes a nervous ring occurs, which surrounds the œsophagus. Some anatomists refer this ring to the cerebellum.

The great thoracic ganglion appears with a marked constriction. The anterior portion throws off lateral twigs to the legs, and to the alary organs; whilst the posterior ganglion distributes, through two large trunks, the nerves which supply the viscera of the abdomen and the apparatus of the reproductive organs.

The Reproductive System.

The generative organs of the Tettigidæ do not greatly vary from those of the Aphididæ; yet certain modifications are to be noted in their external parts. As has been before stated, the external genitalia of the males become much specialised in different genera. Many examples of these peculiar forms are figured in my plates.

The internal parts may be said to consist essentially of one pair of testes, each testis has its vesica seminalis and deferent ducts, which finally open into an ejaculatory canal, bulbous at its root. The penis is of various forms. In *Liburnia* it is sometimes long and straight, except at the end, which is hooked and accompanied by two fine bristles. In *Idiocerus* it occasionally takes a plumose or feather-like form. It is probable that this barbed construction may act as an irritating organ

whilst lying within the vagina. See Plates V., XII., XXXI., and XXXIV.

Burmeister makes some interesting remarks on the forms of the penis in *Centrotus*, &c., and in cases where the ornamental projections on the pronotum would seem to interfere with the approach of the male. Union here must take place whilst the insects are side by side, and a curved penis accordingly he thinks may be necessary (p. 218).

Prof. Ellis Agar gives a remarkable account* of the male parts of *Cicada septendecem*, with an illustration. The external organ mainly consists of a chitinous sheath, of about 0·25 inch in length, which is traversed by a highly elastic tube. This tube can be alternately everted and contracted, at will, within the sheath, as it lies between the vaginal walls. The spinous coat of the elastic tube he thinks may act, as I have above noted, as a stimulating apparatus to the female. When the hooks and claspers are locked together, the sexes cannot hastily be separated without mutilation, as Prof. Riley has shown, and I have noted, elsewhere.

As to the female organs, the ovary is composed of several chains of bilocular chambers, which spring from a common centre. These chambers, which may be as many as forty, develop the ova which pass from time to time down the oviduct, and there meet the contents of the spermatheca before they reach the vulva. The opening is on the ninth somite, and is concealed by two valves which enclose the complex ovipositor. This last curious organ answers two purposes, *viz.*, that of a boring or ploughing instrument, and, by the superposition of the saws and rasp-like laminæ, that of a channel to convey the eggs to the grooves cut by the insect for their nidus.

The anus, as in other insects, is placed above the

* See 'Journ. Trenton Nat. Hist. Soc.,' Pennsylvania, vol. i. Trans., 1887, p. 43.

vulva, and it is mostly surmounted by a hirsute cauda, or anal style.

Dissimilar or asymmetrical appendages are attached to the oviduct. First, the spermal pouch, or spermatheca; and, secondly, the two collaterial glands; which, as in *Aphis*, seem either to lubricate the egg as it passes through the oviduct, or else to secrete the glairy covering, which, at first yellow, afterwards darkens in colour by exposure to the air. In *Tettigonia* there appears to be an additional vascular pouch to the oviduct, the significance of which is not clear.*

The ova of the sub-tribe I denominate 'Silentes' in my Synopsis (p. xxxiv), are remarkably large for the size of the insects, and they do not appear, in their mature state, often to number more than a dozen, and in some species even less.

In 'Stridulantes' they generally occur by hundreds in the same female. The eggs have a tough covering, and when recent are sufficiently transparent to show the germinal spot within, and subsequently the usual yolk segmentation.

Touch and Taste in the Tettigidæ.

The possession of a true tongue, and the presence of salivary glands in some insects, and also the fact that honey is greedily sought by them, must lead to the conclusion that they have some kind of taste-sense. Some insects have this tongue soft and continually moist, which would seem to be a necessary condition of an organ fitted to appreciate flavours. The Tettigidæ seem to have no obvious taste-organs with papillæ, other than salivary vessels and glands.

Such vessels may be more easily dissected out from the soft juicy bodies of the Aphrophoridæ, or Cuckoo-spits, than from the attenuated bodies of the Jassidæ, &c. As might be expected, these glands are most

* Burmeister, Transl. Shuckard, p. 191.

highly developed in the larval stage. The salivary glands, as seen in *Aphrophora*, are drawn on Plate C.

Palpi are wanting in Cicadæ, but it is not improbable that tactile sensations may come from the bulbous hairs of the elytra, and even from the fine setæ which fringe the tibiæ.

The assiduous manner in which the insects comb and brush off dust, clearly shows that their sensitiveness to such matter is acute.

That insects are sensible of something like hearing, has been proved many times, and yet very little is known of the channels by which sound passes on to the nerve centres. So many insects produce sound, either for their own pleasure, as humming or buzzing; or for that of their mates, like chirping; that suitable organs must exist to respond to air-vibrations. The approach of a footstep, or the rustle of a bough, will often stop a whole chorus of Cicadæ for the moment; but the chirping will begin again, as if by a signal, after the cause of alarm has passed away.

Carus, Burmeister, Durkheim, Shuckhard, and others have assigned an auditory office to the antennæ, thinking that it is very unlikely that they can be only tactile organs. The vibratory drums of the Cicada have been already described as sound-producers; yet, merely as a suggestion, it may be thrown out, that as the tympanum of the telephone receives as well as transmits sound, so something analogous might here happen with the Cicada drum. As, however, the female has no visible drums, her auditory apparatus must be of a different type, and must be sought elsewhere.

Soft articulating membranes at the bases of the antennæ of some crabs have been referred to the sense of hearing; and similar membranes placed on or below the antennæ of some insects, which can be rendered more or less tense by the inflection of a joint, have also been thought to have a like auditory office.

An interesting stridulating organ has been found by

Mr. C. Bourne, on the edge of the second joint of the copulatory apparatus of the male *Sphærotherium*, an animal allied to *Julus*. This consists of a chitinous swelling, corrugated by cross-ridges; whilst on the opposite interior surface a rasp-like organ appears, which produces a shrill cricket-like note when rubbed against the aforesaid ridges.

Correlated auditory organs are in this animal placed in fossæ beneath the eyes, and at the base of the antennæ.*

A friend having lent me one of Mr. F. Galton's high-pitch whistles, which are constructed to test and gauge the capacity of the human ear in appreciating acute sounds, I tried its action upon several specimens of *Tettigonia viridis*. The capacity of this whistle can be regulated so as to produce sounds audible to all; or else, by use of the attached screw, to produce waves of such rapidity, that no human ear can appreciate them. Thus the ear of one person may be distressed by a shrill note; of which another person is at the same time entirely ignorant,—different ears failing at definite pitches.

Some fifteen experiments were tried on the *Tettigonia*, but all with negative results; at least the insects did not respond to the chirps of the whistle in such a marked manner, as to lead to the conclusion that they excited them to any action, such as leaping.

Experiments might be tried with better success on individuals of *Cicadetta*, or some other genus of the section Stridulantes.

Smell.

Probably we have little right to argue from the action of our own special organs of sense to those of insects; yet as odours must be caused by minute volatile particles diffused through the air, impinging

* See my observations on the tuberculous drums on the antennæ of some Aphides ('Monograph of British Aphides,' pub. Ray Society).

on olfactory nerves, analogically one might suppose that the sense of smell in insects might be effected through the stomata, with their network of tracheæ or air-tubes, which permeate the bodies of all insects.

A continual stream of air passes through their bodies. This circulation is promoted by the contraction and expansion of the body-rings, — a fact proved by the rapid action of chloroform upon Tettigidæ, and other insects, the stupefying effects of which must be referable to its absorption through these air-tubes. The protecting strainers at the mouths of the stomata also indicate that even gross particles are liable inconveniently to pass these entrances.

Up to the present time, however, no special nerves have been detected in contact with, or spreading over, the tracheal walls or the stomata of insects, which can be at all referable to the sense of smelling. Anatomists have been driven to search elsewhere for olfactory organs, which surely must exist in insects.

Réaumur, Lionet, Dufour, and more lately Sir John Lubbock, all refer to the antennæ for smelling sensations, though the latter author thinks that these parts may contain auditory, in addition to olfactory, nerves. Newport, Wolff, Graber, and others, believe that the antennæ operate as hearing organs, in which department of the senses I am myself disposed to place them.

Life-History.

Although it is incumbent on the entomologist primarily to show the affinities of insects one to another, and to arrange and classify them, as far as may be, in a natural manner; yet to many, the occupation of noting the habits and economy of any group he may choose for his study is the more grateful task. Perhaps no Order of the Animal Kingdom presents in this respect more extraordinary traits than that of Insects.

To this circumstance must be attributed the numerous observers, past and present, who have bestowed their attention on creatures, many of which, though minute, press themselves on our notice, by the influence they exert on human economy. Unfortunately the *complete* life-histories of individual species of insects are not numerous. Close observation, beginning from the exclusion from the egg, through subsequent metamorphic changes, to reproduction and death, involves so much time and exact attention, that few are in the position to give it.

The economic study of the Tettigidæ is yet in its infancy; indeed, little has been done anywhere beyond a classification and description of the species. The author regrets that he can only in general terms state the habits of the insects he describes.

Réaumur, De Geer, and others, have briefly treated on the economy of Cicadæ; and Prof. C. Riley has interestingly shown much of the life-history of the American *Cicada septendecem*, which, after committing its ravages on vegetation, constructs erect and superficial earthen tubes, within which the pupæ undergo their changes. In Syria, large areas of moist earth, at particular seasons of the year, may be seen covered with the pupal exuviæ of Cicadæ, sticking erect out of the ground,—the insects having risen, as it were, from their tombs. This phenomenon probably gave rise to the adoption of the classic emblems of the Tettix or Cicada in connection with ancient Psychic myths.

Prof. Westwood says that the ova in the female Cicadæ, number from three to four hundred, and that she lays them in grooves cut in the branches of trees, or in the stems of grasses, by the action of her saw-like ovipositor. The young hatched from these ova, soon plunge their rostra into the bark of the food-plants, and the irritating action of the three-barbed setæ, within the sheath, causes a plentiful flow of sap to the wound. This juice is absorbed in the same

manner as I have shown to be the case with the Aphides. I have watched this pumping process in the adult forms of *Tettigonia viridis*, which are fond of piercing the rinds of rushes. These insects may be often seen motionless on the stems for half an hour, during which time a large quantity of sap will pass through their bodies, the liquid being voided with a jerk in clear drops, at short intervals, from the anus. These minute drops are projected almost like a shower of small rain. Late in June, near Freshwater, in the Isle of Wight, I have been quite inconvenienced by the large drops of clear liquid shed, by hundreds of Aphrophoræ, upon my paper, whilst sketching under the elm trees.

I have kept the pretty green Tettigonidæ for more than a month under tall glass shades, within which rushes were growing; but I have in vain sought to witness the mode in which the female channels the rind with her saws and rasps. Possibly this operation and that of oviposition take place at night.

The male *Tettigonia* assiduously follows the female, keeping at a respectful distance of perhaps half an inch behind her. He chases her up and down the stalks, and appears to be very attentive in courtship. When alarmed, the insects usually run round to the back side of the stems for concealment, a habit which is familiar to us in birds like our little tree-creeper (*Certhia*), and the woodpecker (*Picus*). These Tettigonidæ pass much of their time in preening and combing their elytra with their hind tibiæ, the edges of which are densely and finely fringed with hair.

A drop of moisture on an insect appears to make it quite agitated, and the combing process then becomes very rapid in movement. At night the Tettigonidæ anchor themselves by their rostra, and appear to sleep. In such cases the approach of a lighted candle does not seem to disturb them.

The complicated ovipositor of the female forms an interesting object for the microscope, when dissected.

Details of such may be seen, Plate XXXVII., figs. 1 *e* and 1 *f*, and Plate B, fig. 6.

The metamorphosis of the Tettigidæ is incomplete; that is to say, both the larvæ and the pupæ are active; they each have six legs and eight abdominal segments.

The larvæ and pupæ assimilate nourishment until the disclosure of the perfect insect. Indications of the wings are easily recognised in the larvæ, but the wing-cases are more developed in the pupæ. Both these stages have considerable resemblances to the imago, but their ocelli and genitalia are more or less in a rudimentary condition. Examples of larvæ will be found in Vol. i., Plates XXIII., XXIV., and XXXVIII., and of pupæ on Plates III. and XXXIII. Immature forms of other species will be drawn also in Vol. ii.

The males are more brightly coloured than the females; and, as is usually the case (when the female carries the male), he is the smallest. *Apropos* to this remark, De Geer says, in their conjunctions the female takes the lead, "et le mâle la suit, ou plûtot il est entrainé par elle." The male sex can always be distinguished by the absence of saw-valves on the under surface. In the Idioceri the antennæ of the males are in most species clubbed at the tip. (See Plate XXXI.).

The ripe ova may often, in late summer, be seen in the females, and, for the size of the insects, they are remarkably large. I have measured those of *Pediopsis*, and they average 0·024 of an inch, or 0·61 millimètre. They are not often numerous within the ovaries of the Tettigidæ, for many females only contain three, and in the genus *Athysanus*, usually only five ova can be counted *ready for extrusion*. The eggs of some species are of a long-oval form, whilst those of *Pediopsis virescens* are slightly bent or turned in opposite directions at their polar ends, thus forming in figure a kind of *f*. The vitelline membranes and numerous oil-globules may in these bodies be readily traced. In

Typhlocyba one single ovum sometimes occupies the entire cavity of the abdomen, and this has much the appearance — but of course not the significance — of the egg of the true female of *Aphis*.

The females of the true Tibicinæ are very prolific, each yielding, as before noted, from two to three hundred eggs. Probably some American species exceed this number, and may approach nearly to the fecundity of the locusts. It is probable that some species of Tettigidæ have more than one brood in the year. Thus *Typhlocyba melissæ* may be taken in early September on the leaves, and quite late in December, under the roots of thyme. Even when the thermometer marked 20° of Fahr., and the snow was an inch deep on the ground, I found many young larvæ very active and leaping vigorously, this low temperature apparently not affecting them or freezing their juices.

The Tettigidæ can hardly be considered gregarious in habit; nevertheless numerous specimens of *Euacanthus interruptus* may sometimes be taken on a single bush of the *Ulex*. Five or six individuals of *Philænus* may be taken occasionally within one mass of spume; and yet, again, small showers of Typhlocybidæ may be started from the hazel bushes (*Corylus*), or the rose trees. As a rule, however, examples are more or less isolated, and in this respect they are unlike *Aphis* and *Coccus*. After the Tettigidæ attain the imago state, their chief occupation appears to be to chirp all day to their mates, to enjoy their short lives, then to oviposit and die.

With the exception of the Aphrophoræ, which attack almost all kinds of trees and plants, the Tettigidæ are much restricted as to their choice of food. Some kinds exclusively affect the oak, others the elm, the maple, the poplar, and the willow; others nestle amongst low plants on dry or sedgy moors; some live on hot and sunlit banks, whilst others hybernate at the roots of furze and heath. Even the tops of high cliffs, like those of the Isle of Wight

above Compton and Freshwater Bays, which are open to rough winds and within reach of the sea-spray, are the habitats of some species. Several of the Delphacidæ may be taken on the high Beacons of Derbyshire and Worcestershire, and the Mountains of Scotland. Finally, the sandy sea-shores of Romney and other places, yield sorts which find their sustenance at the roots of *Arenaria* and stunted maritime plants.

As an anomalous habitat of the "dry Cicada," Mr. Olliff's discovery of the habits of *Tettix australis*, Walk., may be here cited. This species he describes as floating on the surface of the River Nepean, in New South Wales. He remarks that the insect does not confine itself only to the surface of pools, but that it dives several inches below the water, and there clings to the stems of water-plants. (See Proc. Ent. Soc. Lond. for Feb., 1886.)

It cannot be doubted that the colours of many Tettigidæ are protective. The green elytra of *Tettigonia viridis* closely resemble the bark of the green rushes amongst which it lives. The sombre browns of many of the Deltocephali accord well with the hues of the plants on which they feed, and the grey shades of *Idiocerus*, in a general way, render these insects inconspicuous on the silver-like tints of the aspen and willow. The question of the meaning of colour has recently been so well discussed by Mr. Wallace, Mr. Poulton, and Mr. Merrifield, that little can be here advanced as new. If we look at colour merely as a mode of concealment we find that a mere tint, however close it may be to a particular surrounding, is not so efficacious as a variety in marking, provided that the pervading shades harmonise in tone. Amongst birds, the beautiful barring of the nightjar (*Caprimulgus*), the variegated browns of the wryneck (*Yunx*), the ochreous and umber-coloured blotches of the partridge, are all singularly deceptive to the eye wherever the animals choose their nests and make their haunts.

Amongst Lepidoptera the imagoes of the buff-tip

(*Hammatophora bucephala*), the goat-moth (*Cossus ligniperda*), or the wood-leopard (*Zeuzera æsculi*), all in their fine shadings of grey, so effectually merge their colour in the prevailing tints of the willow or poplar barks that, except to the practised eye, they are very easily overlooked. Here beauty, or what intelligence acknowledges to be such, is produced by the choice of curves and the disposition of spots, superadded to the development of those tones which harmonise best with the surroundings. This surely shows, not that such processes are tentative, as has been asserted, but that an admirable wealth of resource may be traced in the adaptation of many means to a single purpose. Form and colour undoubtedly have their economic uses; but many will think there is a real harmony in fitness, and a charm in the study of variety itself.

Claims to a sense of æstheticism have been advanced, with reference to the choice of mates by the females of some insects, founded on the supposition that the brighter-coloured males are more acceptable to them than those of sadder hues. Arguments based on our own tastes and predilections are somewhat hazardous when applied to insects; especially when so little is certainly known as to their faculties of smell, sight, hearing, and touch. It may well be believed that in the fierce rivalry of tigers, the female falls to the share of the strongest male, and that any brighter stripes that he may possess, come only in a secondary sense into the final issue.

Amongst the Tettigidæ probably the females accept any active males that may offer, provided that their advances be made in due season.

The whole subject of the uses and the acquisition of colour in insects is of stirring interest, and competent minds are engaged on it. But mere popular ideas, unsupported by experiment and devoid of evidences on a broad basis, must be discarded. We question the remark lately hazarded that "only those animals display beautiful colours, due to sexual

selection, in whom a taste for colour has already been aroused by the influence of flowers, fruits, or brilliant insects,—their habitual food."

It has been suggested that the brilliant Chrysididæ, which feed on larvæ and which fly in the hot sunshine, do not choose bright flowers, but affect dry dingy-coloured rocks and palings.

How far insects knowingly choose their lairs is yet open to question. Though colour is a lure to some insects, yet it is not actively so in all cases. The bees do not fail to extract honey from the lime blossom, the mignonette, and numerous other flowers, though the petals are pale green, or colourless. Again, the gaudy reds of the *Salvia cardinalis* and the *Abutilon venosum* have not opened to the bees the fact that, within and from their nectaries, honey is secreted so largely that the produce of a single flower is much more than sufficient for a bee to carry away in its honey-stomach in one journey; yet hundreds of flowers of the purple heath must be visited before she can charge herself for the hive!

The effect of odours on insects is perhaps more exemplified than that of colour. The action of a very small quantity of chloroform vapour diluted in air, or that of a volatile cyanide compound, is almost instantaneous on the Cicadæ. Doubtless this vapour is drawn into the tracheæ, and at once it produces stupor. A few puffs of harmless smoke passed into a hive will, for the time, so quiet the bees that they will submit to be handled, and even permit their full honeycombs to be taken from them, without provoking them to sting.

Besides the simulation of colour of their surroundings shown by some species, the Aphrophoræ have the remarkable habit of blowing up a spume or foam under which they hide. Further remarks on this curious economy will be found under the Diagnosis of the Genera.

The ample elytra and wings of the Tettigidæ are

singularly disproportionate to their powers of flight. With but few exceptions, their chief progress through the air is by a series of long leaps. A large number of the Delphacidæ, and some of the Deltocephalidæ, would seem to be losing their wings through a disuse, caused possibly by their unsuitability to the rough winds of the moors, and the marshy plains they usually inhabit.

Whether this be a *vera causa* or not, the fact remains, that the presence of such degraded organs is the rule in some species; whilst side by side with these individuals, but in very reduced numbers, the fully-fledged or macropterous forms are also pretty constantly present.

It is the opinion of some naturalists that a similar degrading cause is operating on certain species of Geometridæ, in which, during the late autumn, the pupæ disclose apterous females. Forests and woods denuded of their leaves are less protected from winds in winter than in summer, and elimination of the wings of these moths at these seasons may be thought to be an advantage to them.

Mr. Wallace remarks, that insects unable to vary rapidly, would soon die out in favour of those capable of easy adaptation. Again, that "groups of individuals, in their struggle for existence, must adopt new habits to enable them to sustain themselves when the struggle is very severe."

Changes in structure in such animals will be brought about, because all parts of an animal are assumed and appear to be continually undergoing variation; those variations only being retained which do not clearly conduce to the animal's welfare.

It will be very interesting to search amongst fossil insects for such transitional forms; where, as here in the case of the Tettigidæ, organs are believed to be undergoing elimination. The occurrence, or otherwise, of such degradation in the ancient geological past, will help us much to make some definite conclusions.

As somewhat bearing on this subject Mr. Charles Darwin asks, in one of his letters to Dr. A. Weismann, "Would it not be worth while to examine the reproductive organs of those individuals of wingless Hemiptera which occasionally have wings, as is the case of the bed-bug?" . . . . "The females of *Mutilla* sometimes have wings. These cases [he argues] must be due to reversion."

Benefits and Injuries done by the Tettigidæ.

In this utilitarian age it may be expected that something should be said as to the benefits and injuries done to man by the Tettigidæ. Whilst a lively interest is evoked in the farmer by the appearance in his wheat crops of the Hessian fly (*Cecidomyia destructor*), or in the apple-cultivator by the unwelcome prevalence in his orchards of the codlin moth (*Carpocapsa pomonana*), the Cicada and its allies are disregarded by the many, because they seem but little to interfere with our own economy: yet in this respect the Family cannot wholly claim the verdict of being "sans peur et sans réproche." The extensive injury done by *Cicada septendecem* in America is notorious. Again, *Delphax saccharivora*, or the sugar-cane fly, is very injurious to the plantations of the West Indies.

Three species of *Idioceri* have been brought to notice quite recently by Mr. W. Gollan, of the Botanical Gardens at Satiarampur, Calcutta, in British India. These Cicadæ subsist on the juices of the young shoots and flowers of the mango. They persist throughout the summer, but the greatest injury appears to be done through damaging the reproductive organs of the plant whilst in flower, and thus preventing the setting of the fruit. These Cicads are described as occurring in some years by myriads. At the request of Dr. E. T. Atkinson these insects have been recently examined and named by M. Lethierry — *Idiocerus*

Atkinsonii, Leth.; *I. nivcosparsus*, Leth.; and *I. clypealis*, Leth.*

Nearer home, the hop-plant is infested with the pretty little *Euacanthus interruptus*. It has been accused of appreciably injuring the crop. This Tettigonid, however, does not appear to be very plentiful anywhere, and its attacks are probably limited to small areas. Its usual range is sparsely over breezy downs and cultivated inland areas.

The salivary excretion of the Aphrophoræ does not seem to be acrid, or to produce much injury to the plants punctured by them for food. If it were otherwise vegetation would much more suffer from the many thousands of cuckoo-spits which sometimes drain the juices of our green produce.

Amongst the British Jassidæ *Limotettix sex-notata* does injury to our corn crops; and *Typhlocyba solani*, Koll., in Austria greatly injures the tubers of the potato-plant.

Observations have been before noted as to the use made of some Cicadæ for human food. Pliny says that the Parthians fed on them, not alone on account of their nutritious qualities, but also because they "opened the veins" (promoted the circulation?), and excited a languid appetite. The white eggs of Cicadæ were eaten as delicacies by the old Greeks and the Romans: their feasts were often furnished with such expensive dishes; and the epicures discriminated between the flavours of the early and late broods, "gustui gratissima." As to the insects themselves, gourmands were particular as to their stages of maturity, the younger males and pupæ being considered to be, as in Aristotle's time, the most delicate in flavour.†

It may be useless for us now to speculate on the grounds of belief in former ages as to the healing properties of certain animals and plants.

* *Vide* 'Indian Museum Notes,' vol. i., pp. 5 and 187, Pl. XII., fig. 1.

† Œlian saw "connexas Cicadas" offered for sale in the markets for food, so that the coarsest animals were purchased in order that nothing (rare?) should be wanting in their feasts.

Eleazar Albin, a man of piety and truthfulness, wrote, in 1736, a treatise on Spiders and Insects, and he illustrated his book with two hundred engravings of different kinds of creatures. Albin personally testifies to the powerful efficacy of clean spider-webs, beaten into froth with the spawn of frogs, for the cure of tertian and quartan agues; and also he asserts that this horrible compound is valuable as a styptic.* He declares, moreover, that *live* spiders, suspended round the necks of children, are very efficacious in certain forms of disease. Doubtless this treatment must have produced rather exciting manifestations in the minds of such patients.

In a similar manner a plaister of powdered Cicadæ mixed with pepper was given by some doctors to those affected with colic; and we are also told that Bp. Lanfranc infused the ashes of Cicadæ in a decoction of radishes, for the purpose of breaking up a calculus. Cicadæ mixed with scorpion oil, also, was a nostrum recommended by some physicians for a counter-irritant, whilst others substituted Cicadæ for cantharides as a diuretic.

As a questionable benefit to man, it may be added that the Cretan boys still take pleasure, as in ancient times, in flying the large Cicadæ in the air attached to light strings, and in certain places these insects are still kept in rush cages for the charm of their music.

The elder Disraeli, in his 'Curiosities of Literature,' remarks, "Dr. Moufet urged that health was dependent on a spare diet, and that he held up the Cicada for our example."

Thomas Moufet, or Mouffet (for his name seems to have been variously spelt), closes his remarks on Cicadæ, in his 'Theatrum,' upon the debated question as to the musical claims made for the chirping of this insect, "Utcunque fuerit, recte de semet ipsa, Cicada cecinit, meo judicio," and yet he is hard on "Senes

* Cobwebs are even now used to check bleeding; the light silky mass assisting in the formation of a coagulum.

atque mulieres vetulæ qui strident." His uncomplimentary remarks on the latter sex probably were evoked by the sarcastic couplet of the Rhodian poet Xenarchus, who, noting that the male Cicada only sings, says—

> "Happy are Cicada's lives
> Since they all have voiceless wives.

"Nature denies the female Cicada a voice to teach our women—

'ὅσσον γύναιξι κόσμον ἡ σίγη φέρει.'"

Some of the Oriental Tettigidæ secrete a kind of semi-crystalline wax, in sufficient quantity to make it worth collecting for commercial purposes. This animal economy is common to the allied tribal divisions of Aphididæ, Coccidæ, and Psyllidæ.

The above insect-wax is formed by a Chinese species of *Fulgorina*. The insects gorge themselves with the sap of a certain tree, and eventually their internal parts become converted into masses which encrust the branches. These masses are melted over a slow fire, and the substance is poured into cold water and washed. The flakes are afterwards melted and run into cakes of pearly whiteness, having a crystalline texture like spermaceti.

"Chinese wax," under the name of Ichang-pe-la, has been experimented upon by the late Sir B. Brodie, and he showed its theoretical interest to the scientific chemist, through its containing one of the natural fatty ethers. Subsequently I showed that, under oxidation, it yields a new fatty acid, and also some of the other little-known acids of the series, which are nevertheless of great theoretical importance.

Kirby and Spence, on the authority of Hardwick, Lund, and others, state that ants in the tropical regions of India and Brazil milk the larvæ and pupæ of various species of *Cercopis* and *Membracis*.*

* Westwood's 'Introd. Mod. Clas. of Insects,' 234—434, vol. ii.

Miscellaneous Notes.

A few remarks may be here added as to the aspect under which the Insects have been drawn in the plates of this Monograph.

It will be readily understood that the relative parts of objects, viewed under the camera lucida, must vary with their perspective positions. It may be well, therefore, here to state that the dorsal aspect, when mentioned, relates to the view from above, the cauda being turned towards the observer. The ventral aspect is similar in position, but viewed from below. The facial aspect represents the Insect with its frons or face turned to the observer in such a manner, that the frons, clypeus, and rostrum can be seen all, or nearly all, in the same plane and focus. It thus will appear that parts like the genitalia may change their apparent form under different aspects.

The length of the head means the distance between the vertex and the neck, even though this space may be shorter than that between the eyes. The breadth of the head consequently means the space from right to left. Thus in *Idioccrus* the head is much broader than it is long.

Dismemberment of the smaller Tettigidæ is often necessary to prepare the details of parts for microscopic examination. These disjointed parts need not be lost. They almost always may be preserved on glass slips, and covered with Canada balsam.

PLATE C.

Alimentary System.

Fig. 1.—*a*. Head with the salivary ducts, and at *s*, *s* the salivary posterior lobes.

l. The ligament supporting the proventrical, or gizzard of Dufour.

c. The crop, or sucking stomach.

d. The ilium, or large intestine, passing into *r*, the dilated cœcum, or rectum.

x. Sebacic glands, in the neighbourhood of *p*, the anal plate.

v. The proventrical, ending in the pylorus.

v'. The convoluted and attenuated part of the stomach, which, forming a complete loop, returns the food to the upper part of the proventrical.

h. Part of the hepatic vessels which add the bile to form the nourishing chyle.—After Léon Dufour.

Nervous System.

Fig. 2.—*c. g*. The bilobed cephalic ganglion, which gives off two bundles of nerves to the oculi, *p*, *p*, and two smaller bundles to the ocelli. The middle fasciculus passes to the base of the rostrum.

t. g. Thoracic ganglion, showing the numerous nerves, *t. n*., which supply the wings and the legs. This large ganglion divides at its lower extremity into two trunks (*d*), which distribute their respective filaments to the abdominal viscera, and run largely also at *f*, *f* to the organs of generation.—After Léon Dufour.

Fig. 3.—Part of the lower stomach of *Aphrophora*, showing its inner glandular structure and the loops at *h*.

GENERATIVE SYSTEM.

Fig. 4.—*a*. Part of the pygofer. *p*. The curled and fringed penis. *t*. The testes, each with its vas deferens and vessica seminalis, which end in the ejaculatory canal. *d*, *d*. Efferent vessels. *v*, *v*. Vessiculæ seminales.

Fig. 5.—The testes of *Aphrophora*.

Fig. 6.—A single sperm-cell, much magnified.

Fig. 7.—Many-chambered ovary of *Aphrophora*, with the eggs in different stages of maturity.

The last three figures are after Burmeister.

BYTHOSCOPUS ALNI, *Schr.* Plate XXVIII., figs. 1 to 1*c*.

Cicada alni, Schrank.
Jassus alni, Boh.
Pediopsis Heydenii, Kirschb.
,, *alni*, Thoms., Sahlb.
Bythoscopus alni, Scott; Edw. pt. i. p. 106.

Male. Vertex and frons ochreous-yellow; usually with a dark space, and two round dots in the middle of the first. Eyes reddish. Pronotum greyish, with a slight upper carina, with a broad medial stripe, and two irregular marks towards the upper margin, finely striated. Scutellum yellow, with the peculiar mask-like marking and transverse indentation which are so curiously persistent throughout the Tettigidæ, even to the minute Typhlocybidæ, the least specialized forms of the group. Elytra long, and when closed making the insect appear pointed behind. Membrane brownish yellow, with a broad brown fascia from the costal edge succeeded by a smaller spot nearer the apex. The neuration strong and coarse. The transverse nerve of the basal, and that of the lower discoidal cell much thickened. Wings hyaline. Frons or face tumid, finely punctured with orange-yellow. A black stripe on each side. Antennæ in deep fossæ. Clypeus rounded. Rostrum short. Legs quadra-prismatic. Outer edge with coarse spines; the inner edge finely fringed with hair.

Female. Similarly coloured to the male, but much less brightly marked. The abdomen is of a reddish brown. In some examples the head and pronotum are black, and abdomen olive.

	Inch.	Millimètres.
Expanse	0·47	12·00
Length of body	0·20	5·00

Common on the Alders. Huddersfield, Haslemere, and elsewhere.

BYTHOSCOPUS RUFUSCULUS, *Fieb.* Plate XXVIII., fig. 2 to 2 *c*.

Bythoscopus rufusculus, Fieb.; Scott.
Pediopsis fruticola and *frontalis*, Flor.
,, *brevicauda*, Thoms.
Bythoscopus rufusculus, Edw. pt. i. p. 106.

General colour rufous-yellow. Vertex somewhat pointed, and less than one-fifth of the length of the pronotum. Two small dots near the eyes. Striations blackish. Scutellum with faint mask-mark. Abdomen fusiform and pointed, obscurely barred with brown. Legs yellowish. Hind tibia with a fine black line near to the tarsus. Elytra with a brown fascia. The two discoidal and the three subapical areas white and transparent. Head, viewed from the front, very flat, and showing a fine carina from eye to eye. Underside all rufous.

	Inch.	Millimètres.
Expanse	0·320	8·13
Size of body	0·18	4·56

This insect is rather variable as to colour. Taken on willows and birches near Haslemere, &c.

BYTHOSCOPUS FLAVICOLLIS, *Linn.* Plate XXVIII., figs. 3 to 3 *a*.

Cicada flavicollis, Linn,; Edw. pt. i. p. 106.
Jassus reticulatus, *ferrugineus*, *flavicollis*, *pulchellus*, *fenestratus*, and *personatus*, Curt.
Pediopsis fruticola, Flor; Marsh.; Kirschb.; Thoms.
,, *flavicollis*, Sahl.
Bythoscopus fruticola, Fieb.; Scott.

The variability of this species is shown by the large synonymy which I have taken from Mr. Edwards's

'Synopsis.' It is there stated that the species is always easy to distinguish from others "when once the structural characters of the face have been appreciated." These characters do not appear to be given, except that "the face above and the crown is more or less yellow."

Frons yellow, convex, roughly punctate, with two dark brown depressions or shallow patches on each side. Ocelli distinct. Eyes warm brown and prominent. Whole of the pronotum and scutellum sulphur-yellow, as also is the shoulder of each elytron, passing into greenish. Elytra warm brown, with raised pale nervures. Wings whitish hyaline. Anterior tibiæ outwardly channelled.

Sahlberg gives still more numerous synonyms than above, and besides these he notes fifteen colour varieties.

Smaller than *B. rufusculus*. Taken near birches, in short grasses, at Huddersfield and other places.

	Inch.	Millimètres.
Expanse	0·28	7·0
Length of body	0·18	3·0

Both this and *B. rufusculus* feed on the birch, and possibly they may hereafter be found to be identical species. Indeed, apart from size and the colour-characters, it is very difficult to separate them from the foregoing species.

Genus XXII.—PEDIOPSIS, *Burm.*

Head with the eyes not broader than the pronotum. Pronotum with straight and horizontal striations, and with "sculpturing." Face in the form of a lozenge. Limbus on the elytron mostly absent, or else confined to a mere border. Apical cells to the elytra four or five, and squarish. Tibiæ strongly and numerously toothed on the inner side. Tarsi as in *Idiocerus*.

From Πέδιος, Πεδιοψις, *Flat-face*.

In a manner, the British species may be partially separated thus :—

Colour all green . . .	*Pediopsis virescens.*
Face convex	*P. tiliæ*, *P. nanus*, *P. scutellatus*, *P. tibialis.*
Face flat and spotted . .	*P. nassatus*, *P. fuscinervis*, *P. impurus*, *P. distinctus.*
Face unspotted and flat .	*P. ulmi*, *P. cereus.*

N.B.—For examples of the convex and the flat contour of these faces, see Plate XXXI., in which fig. 1 *a* represents that of *P. scutellatus*, and fig. 1 *b* represents that of *P. virescens.*

Pediopsis virescens, *Fab.* Plate XXIX., figs. 1 to 1 *a*.

Cicada virescens, Fab.
Jassus prasinus, Boh.
Pediopsis prasinus, Fieb.
P. virescens, Flor ; Marsh. ; Fieb. ; Thoms. ; Sahlb. ; Scott ; Edw. pt. i. p. 114.

Crown angular, with two darkish spots on the edge. General colour of the whole insect lively green. Abdomen a little darker on the dorsum. The body-rings with pale edges. Apex acute. Femora green. Tibiæ browner, with a series of strong spurs on the inner side, and small setæ on the outer edge. Elytra with diffused and ill-defined nervures, which have a tendency to run into each other. Apex with a broad border. Wings bluish white. The males have the dorsum nearly black.

Not uncommon on willows near Haslemere, Huddersfield, and elsewhere.

In the autumn I have taken females with three or more large ova ready for exclusion.

	Inch.	Millimètres.
Expanse	0·19	4·81
Body and wings	0·17	4·31

PEDIOPSIS IMPURUS, *Boh.* Plate XXIX., figs. 2 to 2 *b*.

Jassus impurus, Boh.
Pediopsis impurus, Thoms.; Sahl.; Scott; Edw. pt. i. p. 112.

Male. General colour ochreous. Vertex with a black spot. Pronotum grey, with a widening black streak on each side of the upper margin. Scutellum with the usual dark brown triangular marks which help to form the skull-like representation. Abdomen black. Elytra greyish, with brownish nervures. Legs ochreous-yellow; the hind femora and tibiæ each with a fine black line and a dot. Frons yellow and flat when viewed in front; with six black dots and a streak crossing the clypeus.

The female is much larger than the male, and very similarly coloured.

Body with wings, 0·14 inch, or 3·55 millimètres.

Pediopsis distinctus var. *impurus*, Scott; Edw. pt. i. 112. Plate XXXI., fig. 1.

The appearance and the description of this insect are so similar to that of *P. impurus* that I hesitate to admit it as a new species. Doubtless something more of the life-history of all these small insects is very desirable; and until this is forthcoming I think it will be well to reduce our list of species to those forms which can be described with characters of some import.

My figure is from Mr. Douglas's cabinet. It appears

to be rather paler in tint than *P. impurus*, and perhaps the vertex is more pointed. The costal stripe noted by Mr. Edwards appears to be wanting in some specimens.

PEDIOPSIS NANUS, *H.-Sch.* Plate XXIX., fig. 3.

Bythoscopus nanus, H.-Schff
Pediopsis nanus, Flor; Kirschb.; Fieb.; Sahl.; Scott; Edw. pt. i. p. 109.

Male. Pale ochreous. Pronotum brown, somewhat tectiform, with a pale ridge and pale borders below. Scutellum with a brown cross, and with two small dark dots accompanied by the usual broad triangular marks at the pronotal base. Abdomen black. Elytra grey, with brown nervures. Legs concolorous ochreous-yellow, with a fine dark line on the hind tibiæ.

The female has its vertex and its frons yellower than the male. It is considerably larger.

Size of the body, 0·13 inch or 3·30 millimètres.

On short grass, at Boxhill, in July. Example from Mr. Douglas's cabinet.

PEDIOPSIS FUSCINERVIS. Plate XXIX., fig. 4.

Jassus fuscinervis, Boh.
Pediopsis fuscinervis, Thoms.; Edw. pt. i. p. 111.
,, *nassatus*, Sahl.

General colour pale. Vertex pointed, with a black spot on the summit. Eyes dark brown; a fine and gradually thickening line passes to the base of the eyes. Pronotum with very fine oblique striations. Scutellum with the "Death's-head" very distinctly marked. Elytron almost white, with pale brown

nervures, and with a brownish cloud near the apex. Wings grey. Legs concolorous with the elytra, and thickly setose. Face spotted. Abdomen black above.

The female is more ferruginous than the male in colour.

On the poplar and aspen.

Body with wing, 0·17 inch, or 5·0 millimètres,

PEDIOPSIS ULMI, *Scott*. Plate XXIX., fig. 5.

Pediopsis ulmi, Edw. pt. i. p. 113.

Upper-side warm sienna-brown. Elytra sub-opaque, with "the costa narrowly dark brown," and concolorous nervures. Hind tibiæ with a black narrow streak on the inner side. Abdomen of the male black; that of the female brownish yellow.

This insect is very like the unbarred variety of *P. cereus*, but it wants the above-noted brown costa, and its habitat appears to be different.

Size, 1·97 inch, or 5·0 millimètres.

Taken on elms at Lee, Norwich.

My figure is from a specimen taken by Mr. Scott; now in Mr. Douglas's cabinet.

PEDIOPSIS TILIÆ, *Germ*. Plate XXIX., fig. 6.

Jassus tiliæ, Germ.

Pediopsis tiliæ, Flor; Kirschb.; Fieb.; Thoms.; Sahl.; Scott; Edw. pt. i. p. 109.

Very like *P. ulmi*, except that the head and pronotum are much paler; the insect is less ferruginous-red, and the legs are pale ochreous, without the brown streak. They are slightly spotted. Abdomen black.

Length of body and wings, 0·21 inch, or 5·5 millimètres.

Example from Mr. Douglas's cabinet.

Rare. Said to occur on *Tilia parvifolia*, at Esher, in June. Sahlberg says it is also found on the same tree at Stockholm, and at other places.

PEDIOPSIS CEREUS, *Germ.* Plate XXX., figs. 1 to 4 *a*.

Jassus cereus, Germ.
Pediopsis cereus, Fieb.; Scott; Edw. pt. i. p. 113.

Pale ochreous-brown. Frons ochreous-yellow. Head and pronotum rather greyer, with the striations on the latter part oblique. Scutellum with the usual brown marks. Abdomen fusiform. Two brown dots above the pointed apex, followed by several fine and wavy cross lines up to the scutellum. Elytron with a brown apical cloud, and an irregular warm brown and transverse bar on the middle. Wings transparent brown, with neuration rather paler. The legs ochreous-yellow. The female is very similarly coloured.

	Inch.	Millimètres.
Expanse	0·36	8·0
Body and wing	0·17	4·5

Common on sallows at Brockenhurst, and in many other places. The brown bars on the elytra are not always present.

PEDIOPSIS NASSATUS, *Germ.* Plate XXX., figs. 2 to 2 *a*.

Jassus nassatus, Germ.; H.-Schäff.
Bythoscopus nitidulus, H.-Schäff.
Pediopsis planicollis, Thoms.
,, *nassatus*, Flor; Kirschb.; Sahlb.; Scott; Edw. pt. i. p. 111.

Head, pronotum, and scutellum pale ochreous, with greyish striations and sundry brown spots. Elytra

grey-brown, with dark neuration. Legs rufous, and unspotted in the females. Male tibia with a black stripe on the inner side. Frons flat, yellow, with two upper large round dots, and two comma-shaped dots below. Two spots on the seats of the ocelli.

Size, 0·18 0·07 inch, or 4·56×0·18 millimètres.

Scarce. Said to feed on sallows.

PEDIOPSIS SCUTELLATUS, *Boh.* Plate XXX., figs. 3 to 3*a*.

Jassus scutellatus, Boh.
Bythoscopus diadema, H.-Schäff.
Pediopsis diadema, Kirschb.
,, *scutellatus*, Flor; Marsh.; Thoms.; Sahlb.; Scott; Edw. pt. i. p. 110.

Head pale yellow, with from four to nine round black dots on the vertex. Pronotum brown, with yellow blotches. Scutellum greyish yellow, with brown triangular marks and two dots above the transverse suture. Abdomen black. Elytra with a violet tinge, concolorous, with black nervures. Legs lemon-yellow, each hind tibia with four or five reddish spots.

Length with wing, 0·22 inch, or 5·5 millimètres.

Taken on sallows, &c.

PEDIOPSIS TIBIALIS, *Scott.* Plate XXX., figs. 4 to 4*a*.
Edw. pt. i. p. 110.

Colouring and markings not unlike P. *scutellatus*, but the two upper facial spots have a tendency to become comma-shaped (Edw.). The elytra also in the specimens sent to me from Norwich are more rounded in outline, and the insects are of a browner tinge. The chief difference appears to be in the markings of the hind tibiæ, which have each two separated black lines

with a spot at their base, and each of the femora has a brown patch upon it. The female is more bronzy and shining.

Mr. Edwards records it "not uncommon near Norwich in mixed hedges and amongst brambles."

As specimens occur without the tibial dashes, it may be doubted whether P. *tibialis* be a distinct species.

This insect occurs also on poplars in June and August, and Dr. Capron also has taken it at Shiere.

Expanse, 0·36 inch, or 9·12 millimètres.

Genus XXIII.—IDIOCERUS, *Lewis*.

Head with the eyes broader than the pronotum. Ocelli, when visible, facial; with a frontal suture running between them. Antennæ of the males — except in *I. distinguendus*, *I. tremulæ*, *I. vitræus*, and *I. aurulentus* —clavate, and inserted in a shallow cavity. Frons rounded in front. Elytron membranous, with a limbus or border overlapping the apex. Scutellum trigonate, generally marked by two conspicuous, triangular, dark basal marks; which, with two black dots and a lower deep horizontal groove, very fancifully represent a "death's head." This singular representation also may be seen in our Great Sphinx-moth, *Acherontia atropos*. Elytra longer than the body, and reticulated into oblong cells, the costa in some males being thickened and striated as in *I. adustus*. The elytral nervures are often lost in the substance of the membrane. Legs rather short; the hind tibiæ sometimes have a coronet of short spines, and an extra row of fine setæ. Pulvilli bilobed.

J. Curtis, in his 'British Entomology,' names six indigenous species; but later writers have described seventeen or more species. Most of these I have figured in the plates of this Monograph; but it may be anticipated that ultimately some of these may prove to be varieties only. This seems to be the more likely,

since as many as nine species are to be taken on the botanical genus *Populus*, and five at least on the genus *Salix*.

Mr. Edwards tabulates the Idioceri partly with reference to the forms of the first and second apical areas of the elytra. He then broadly, for the purpose of identification, takes note of the presence of transverse bandings on the alary organs, or the absence of the same.

For the purposes of a preliminary examination I have also drawn up a table which may afford some additional help. In a general manner *Idiocerus* may be separated from *Pediopsis* by an attention to the greater width of the head and eyes taken together, as above noted.

IDIOCERUS FULGIDUS, *Fab.* Plate XXXI., figs. 2 to 2 *d*.

Cicada fulgida, Fab.
Jassus fulgidus, Fab., Germ.
Idiocerus ochroleucus, Kirschb.
,, *minki*, Kirschb.
,, *fulgidus*, Edw. pt. i. p. 124.

Fine orange-yellow. Vertex often of a paler brown. and immaculate. Antennæ of the males clavate. Scutellum as deep as the pronotum, with two triangular basal patches, and two more or less faint spots on the disc. Elytron bright yellow, rather smoky towards the apex; nervures darker yellow, but whitish towards the claval suture. Abdomen black. Legs fine yellow, with yellow setæ on the hind tibiæ. Claws black. Frons pale yellow, and indented below the eyes. Centre of the frons stained irregularly with red. The pygofer of the male is remarkable in form. A long tube with a cleft and a plumose bristle issues from below the cauda. The lower valve is biarticulate and pilose.

The female is larger and of a greener shade, and

the black tints are confined to the dorsal line of the abdomen.

Body, with wing, 0·26 inch, or 6·60 millimètres.

Common on poplar trees. Norfolk fens.

I. fulgidus is not unlike *I. confusus*, but it has stronger basal marks on the scutellum, and has less pronounced yellow edges to the abdominal rings. The pygofer also differs in form.

Idiocerus populi, *Linn.* Plate XXXI., fig. 3.

Cicada populi, Linn.

Idiocerus populi, Flor; Kirschb.; Sahlb.; Edw. pt. i. p. 124.

Male. Vertex, pronotum, and scutellum, honey-yellow. Part of the frons and the clypeus reddish. Two dark brown elongated spots between the head and the pronotum, and two smaller spots behind them. Apex of the scutellum greyish. The base marked with the usual triangular spots, and a deep, transverse, lower depression. Elytra subopaque, pale brown, and yellower towards the costa. Nervures dark brown, except "the middle third and the apex of the anal nerve, which is white. Hind legs brownish; other legs orange-yellow. The female sometimes is of a pink colour.

Size, with wing, 0·21 × 0·07 inch, or 5·33 × 1·77 millimètres.

Feeds on the aspen, *Populus tremula*.

This insect may be partly known from its orange-yellow legs, and the deep depression on the scutellum.

IDIOCERUS ADUSTUS, *H.-Schff.* Plate XXXI., fig. 4 to 4*b*.

Bythoscopus adustus, H.-Schff.
Idiocerus stigmaticalis, Lewis.
,, *varius*, Marsh.
,, *adustus*, Kirschb.; Sahl.; Scott; Edw. pt. i. p. 116.

General colour fuscous-grey or dirty ochreous. Two black dots on the vertex near the eyes. Eyes reddish. Antennæ of male clubbed at the tip. Pronotum irregularly stained with brown or black. Scutellum with three triangular patches, and with several smaller black dots. Apices of the elytra orange-yellow. Bases brown, with dark veins, some of which are nearly obsolete by fusion into the chitinous membrane. The costal vein furnished with five or six conspicuous tubercular teeth, and the nerve below punctured with as many black spots. A whitish patch occurs just before the second apical cell. The apex of the elytra is usually of a pinkish red colour. The frons is occupied by a suffused green patch, within which two large brown stains appear, succeeded by two minute punctures just above the insertion of the antennæ. The cheeks of the male are clothed with a fine silvery pubescence.

Body and wings 0·26 inch, or 7·00 millimètres.

Inhabits various species of *Salix*.

The presence of the above-noted tubercular teeth on the costa is a good discriminating character. The neuration of the elytron in my plate is rather abnormal.

IDIOCERUS CONFUSUS, *Flor*. Plate XXXII., figs. 1 to 1*c*.
Kirschb.; Sahl.; Edw. pt. i. p. 125.

Colour uniformly pale ochreous or dusky grey. Frons white and unspotted. Pronotum, scutellum,

and costal vein of the elytron greenish. Apex of the elytron rather fuscous. Neuration indistinct. Legs greenish yellow; claws black. Antennæ of male clavate. Abdomen with seven black bars, pointed, and yellow on the edges of the somatic rings.

The greenish hue of the live insect is soon lost after death.

	Inch.	Millimètres.
Expanse of wings	0·50	12·7
,, body	0·25	6·36

Common on sallows. Godalming and other places.

This species is greyer than *I. fulgidus*, with which it may be compared.

Idiocerus laminatus, *Flor.* Plate XXXII., figs. 2 to 2*b*.

Marsh; Kirschb.; Sahl.; Scott; Edw. pt. i. p. 120.

General colour dirty concolorous yellow, rather darker brown on the clavus. Vertex either unspotted or marked only with two pale stains. Pronotum greyish. Scutellum either brown, or this tint is restricted to the two usual triangular patches. Frons, viewed from the front, with four pale spots, circumscribed by fine lines. Abdomen pointed, greyish, and furnished with two black dorsal marks.

The apical third of the elytron on the corium is whitish, whilst the apex itself is brown. Nervures punctured.

"On poplars; not common." My figure is from Mr. Douglas's cabinet; but I have specimens from Brockenhurst, in the New Forest.

Size of body, 0·25×0·07 inch, or 6·35×1·7 millimètres.

IDIOCERUS VITREUS, *Fab.* Plate XXXII., figs. 3 to 3*b*.

Cicada vitrea, Fak.
Idiocerus H-album, Fieb.; Scott; Edw. pt. i. p. 122.

Vertex of a dingy white, more or less mottled, with two dark rusty spots. Pronotum dirty ochreous, delicately punctured, two dusky lines enclose a whiter space; each line has a black puncture. Scutellum honey-yellow, with the usual black triangular spots. Elytra yellow-brown; nervures punctured; the transverse nerve and the apex of the clavus whiter. Wings iridescent. Abdomen dark brown, the edge of each segment yellowish. Frons yellow, with two large pyriform brown spots, and two wavy rusty brown lines proceeding from the eyes to the rostrum. Two round spots mark the upper part of the frons. Legs pale ferruginous, with a pale brown hind tibial streak.

The males are darker and smaller than the females.

Not uncommon on *Populus alba*.

Length, with wings, 0·20×0·07 inch, or 5·08×1·77 millimètres.

A general character may be found in the transparent, horny, and honey-brown tint of the elytra.

IDIOCERUS VARIUS, *Fab.* Plate XXXIII., figs. 1, 1*a*, and Plate XXXIV., fig. 6.

Jassus varius, Germ.
Idiocerus varius, Kirschb., Cicad. 154, 4; Edw. pt. i. p. 117.

The male. Head, pronotum, and scutellum, dirty ochreous-white, the former rather smoky on the anterior edge. Frons pubescent. The pronotum much mottled with dark brown stains. The scutellum dusky grey or yellowish, and marked somewhat like the

previous species. Abdomen brown, with yellow edgings to the body-rings: apex cleft, but under a high magnifying power seen to be constituted of two fasciculi of long hairs. Elytra greenish hyaline, sometimes having on each a broad band; but always furnished with coarse, more or less disjointed, brown nervures, giving the organs a brocaded appearance. Limbus rather narrow. Wings delicate and iridescent. Legs ferruginous; all the tibiæ are furnished with a fine dark stripe.

	Inch.	Millimètres.
Expanse	0·50	11·5
Length of body	0·17	4·5

Feeds on *Salix triandra*. The *I. similis* of Kirschbaum appears, from a comparison with Dr. Puton's types, to be identical with this species. Its chief difference would seem to consist in a brighter yellow costa and a somewhat conspicuous round costal spot.

The female has its frons much clouded and speckled. The pubescence on the cheeks is less marked than in *I. adustus*, which in many respects it resembles.

The elytra, however, are more banded, and the nervures are coarser. Also the tubercles on the costa, very marked in *I. adustus;* are here barely visible.

Idiocerus Herrichii, Kirschb. Plate XXXIII., fig. 2, 2*c*. Edw. pt. i. p. 117.

Head and eyes wide; vertex yellow, with a greenish grey irregularly-shaped stain between the eyes, which is carried over and down the frons. Two black dots occur near the eyes. A dark line separates the head from the pronotum, which last has several small brown marks. Scutellum of a pale greyish green, with brown triangular patches. Abdomen black. The membrane of the elytra unevenly mottled with greenish, with brown and fuscous yellow tints. The costa stout, imbricated, and marked by three long dark dashes, but

not furnished with teeth. The radials stout, and each coloured partly white and partly black. Wing iridescent, with coarse veinings. Legs pale grey; outer edges of the hind tibiæ furnished with brown setæ; the inner edges marked with brown tibial streaks. The frons or face is yellow, with an upper grey mark. Brown comma-shaped, and also other roundish dots, are on the disk, and near to the clypeus. The fore femora and tibiæ are streaked with brown.

Length, 0·25 inch, or 6·5 millimètres.

Feeds on *Salix alba*. This insect is scarce. My specimen is figured from one lent to me by Mr. Edwards.

Idiocerus lituratus, *Fall.* Plate XXXIII., figs. 3 to 3 *d*.

Bythoscopus lituratus, H.-Schäff.
Idiocerus maculipennis, Curt., Brit. Ent. fig., p. 733, 3.
,, *lituratus*, Flor; Marsh.; Kirschb.; Sahl.; Scott; Edw. pt. i. p. 120.

Vertex yellowish, stained with ferruginous. Pronotum of the same tint, and spotted with brown. Scutellum normally marked with a recurved, transverse, indented streak. Elytra with a pale greyish hyaline membrane, with a whitish patch on the corium, just beyond the apex of the clavus. Nervures stout and brown. Two deltoid dark brown spots occur between the third and fourth radial nervures, and a broad brown spot appears on the apex of the clavus. The legs pale. The hind tibiæ with brown setæ, and a dark streak on the inner side. Frons and most part of the under-side orange-yellow. The saw-groove black.

This species with its closed wings has some resemblance to *I. varius*. The banding and dark dashes on the elytra are best seen by transmitted light.

My figure is from Mr. Douglas's cabinet, but I have numerous examples in which the colours are almost

concolorous, and some from Brockenhurst in which the insects are uniformly brown.

The male pygofer ends with a rounded plate, terminated by three long setæ (fig. 3 *b*).

	Inch.	Millimètres.
Expanse	0·48	12·18
Length	0·20	5·08

Common on sallows in Foxley Wood, Norfolk, in September; and in the New Forest, Hampshire.

Idiocerus albicans, *Kirschb.* Edw. pt. i. p. 125. Plate XXXIV., fig. 2, and Plate XXXV., fig. 2.

Head, pronotum, and scutellum, greenish white. Almost the whole of the male insect is spotless white. Sometimes the greenish scutellum has indications of the two dark triangular basal patches. The elytra are nearly white or pale grey; the nervures white, and often imperceptible. The nervures of the wings darker than the membrane. The abdominal male segments sometimes are narrowly black at their bases. Under-side all white, or very pale green.

Feeds on *Populus alba*, and is common near Huddersfield and round about Norwich, &c. It may be generally recognised by the pale and mealy-like character of the elytra.

Length, with wings, 0·25 inch, or 6·5 millimètres.

Idiocerus pœcilus, *H.-Schäff.* Plate XXXIV., fig. 3, 3 *a*, and fig. 4.

Bythoscopus pœcilus, H.-Schäff.
,, *falciger*, Boh.
Idiocerus falciger, Sahl.
,, *venustus*, Scott.
,, *pœcilus*, Kirschb.; Edw. pt. i. p. 121.

Head, pronotum, and scutellum, umber-brown, with dark streaks separating each of these three parts. Abdomen umber-brown, with a dorsal ridge, and darker somatic rings edged with paler tints. Cauda obvious. Elytra brownish hyaline; nervures black or brown, disjointed with white, showing the membrane as if streaked with brown bars. Wings greyish, with brown nervures. Legs pale; hind tibiæ with a brown streak. Frons pale ochreous, with numerous streaks placed at different angles. Pigment of the eyes partially deposited on the cornea.

The figure marked 3, with closed wings, in my plate, is from an insect in Mr. Douglas's cabinet, and marked *falciger* of Boheman. It is yellower than the ordinary form of *pœcilus*, but the dashes on the elytra well accord with those of that species, and justify its being considered identical.

I. pœcilus may be compared with *I. lituratus*.

Length, with wings, 0·25 inch, or 6·5 millimètres.

IDIOCERUS DISTINGUENDUS, *Kirschb.* Plate XXXIV., figs. 1 to 1 *c*.

Idiocerus distinguendus, Kirschb.; Edw. pt. i. p. 118.
,, *cognatus*, Fieb., E. B. 455, 10.

Male. Head dusky ochreous, with six dark dots ranged in a semicircle round the anterior edge of the vertex, and two faint bluish stains on the disc. Pronotum greenish, with ochreous brown cloudings, with the usual mask-like marks dark brown. Eyes blue-grey. Abdomen pale ochreous-yellow, with a broad grey dorsal patch crosed by black edges of the somatic rings. The apical portion paler. Cauda black, with a yellow tip. Elytra milky white and nearly transparent, with a broad and darker limbus. Nervures brown, but disjointed with white, thus appearing to the eye as fine brown streaks on a whitish ground. Wings iridescent. Legs pale and pinkish, with light

yellow setæ on the tibiæ, and with black claws. Antennæ clavate at the tips, with two minute bristles at the bases of the third joint.

Expanse, 0·40 inch, or 10·16 millimètres.

Female, with the wings closed, milky grey. The head and pronotum darker. The elytra marked by a broad spot across the dorsum at the apex of the claval suture, or by two rounded patches.

My first figure is from an example kindly presented to me by Dr. Capron, who captured it at Shere, near Guildford. The figure on Plate XXXIV. is from an example given me by Mr. Douglas as *I. cognatus*, who found more than fifty individuals feeding together on *Populus alba*, in September, at Lewisham; two only of these were males. In the following August, and in the same place, he found several males, from which circumstance he gathers either that the insects are polygamous, or that in the autumn "a republic of widows is formed," which must be in full vigour, since their female colours are brighter and gayer than previously noticed. Mr. Douglas concurs in Mr. Edwards's identification of Kirschbaum's *I. distinguendus*, which last name has priority.

Easily confounded with *I. tremulæ*. See Ent. Mo. Mag. vol. xxii. p. 115.

Length of body and wings, 0·18 inch, or 5·0 millimètres.

Idiocerus tremulæ, *Estl.* Plate XXXV., fig. 1.

Cicada tremulæ, Estl., Act. Holm. 129, pl. 5, fig. 3, 1796.
Idiocerus unifasciatus, Curt.
,, *tremulæ*, Flor; Marsh.; Kirschb.; Sahl.; Scott; Edw. pt. i. p. 118.

Exceedingly like *I. distinguendus*, but the female is larger. The only example I have seen is from Mr.

Douglas's cabinet. Mr. Edwards says it is best distinguished from the preceding species "by the brown bands of the elytra reaching to the costa;" but it is not easy to decide where the undefined band really ends.

Pale yellow, variegated with brown; vertex very finely punctured. Pronotum with one thick brown mark, and one fine brown line on each side. Scutellum with three more or less confluent dots. Elytra shining, hyaline, with a medial ochreous-brown fascia. The costal edge pale. Between this fascia and the apex a milky white space. Apical nervures fuscous-brown. Abdomen black above. Legs and feet yellow.

Rare hitherto. Lives on the leaves of *Populus tremula*. Habitat, England, France, and Finland.

Length of body, 0·20 inch., or 5·50 millimètres.

Idiocerus elegans (*Burm.?*). Plate XXXV., figs. 3, 3 *a*.

Idiocerus elegans, Flor, Rhyn. Liv., ii. 147; Sahl.; Edw. pt. i. p. 119.

Body fusiform. General colour ochreous-brown or ochreous-yellow. Frons greyish, with brownish edgings. Eyes, fore and hind margins of vertex, fuscous-brown. Pronotum and scutellum with faint ferruginous dashes or mottlings. "Ocelli as distant between themselves, as they are from the antennæ" (Sahl.). Abdomen fusiform, pointed. The last genital segment of the male is strongly notched. Colour yellowish, marked by seven broad brown spots or bandings. Some examples show the abdomen all black. Legs yellow, and fringed with fine setæ. Elytra shining, with a ferruginous clouding near the base, and paler near the apex. "Pone medium fascia albido-hyalino" (Sahl.). Neuration obscure, but some of the stronger veins brown. Wings greyish.

The female is of a generally rusty red colour, and has two small white spots on the crown. Two brown spots occur on the scutellum.

This insect may be taken on *Populus tremula*, and on several species of *Salix*, but it is not common.

Dr. Capron took an insect on the Scotch fir, in "March or April," which differs in colour from the above, but which may be nevertheless referred to *I. elegans*.

	Inch.	Millimètres.
Expanse	0·42	11·0
Body	0·21	5·5

Idiocerus nubilis, *Buckton*. Plate XXXV., figs. 4, 4 *a*.

Male. Head and thorax broad. Abdomen long-conical. Apex rounded, and fringed with brown bristles. General colour, with the exception of the abdomen, bronzy- or olive-green. Eyes black. Pronotum with a sinuous brown transverse streak. Scutellum with a horizontal wavy line, followed by the usual transverse furrow. Elytra with apices rounded, and with brown limbi. Neuration obscurely yellow. A triangular brown spot occurs at the apex of each clavus. Wings grey. Abdomen greyish black, with dark segmental markings. Pygofer of the male with two stout horny processes below, surmounted by the cauda and the genital valve, and a conical tube, from which the curved penis proceeds. The first tarsal joint twice the length of the second, or of the third. Antenna with two stiff side setæ on the terminal joint. Legs greenish.

As I cannot refer this insect, taken at Haslemere, Surrey, to any known *Idiocerus*, I name it as above, from the cloudy appearance of the elytra. It has some of the characters of *I. albicans*.

Expanse, 0·39 inch, or 10·6 millimètres.

IDIOCERUS TIBIALIS, *Fieb.* Plate XXXV., figs. 5, 5*a*.

Idiocerus tibialis, Fieb., E. B. 452; Edw. pt. i. p. 122.
,, *affinis*, Fieb., *l. c.* 454.
,, *Heydeni*, Kirschb.; Scott.
,, *vittifrons*, Kirschb.
,, *rotundifrons*, Kirschb.

General colour pale ochreous. Vertex rounded, with greyish stainings on the fore margin. Ocelli distinct and dark brown. Eyes grey. Pronotum with a fuscous stain on each side blotched with black. Scutellum with two triangular black marks, and with the usual mask-like dots. Elytra yellowish grey, with the principal nervures white and black, so as to give the membrane an angularly streaked or a chequered appearance. Abdomen with a brown band across each segment. Legs pale; the hind pair with a fine black line on the outer edge of the femur, and the same on the inner side of the tibia. Frons yellow, rounded, and marked by two broad greyish stains. A black dot appears between each of these stains and the eye.

This appears to be a rare insect. My figure is from Mr. Douglas's cabinet, who took it at Darenth in October.

Length of body, 0·23 inch, or 6·0 millimètres.

IDIOCERUS VIDUATUS, *Edwards*, pt. i. p. 118.

This "fine and very distinct species" I have never seen, and Mr. Edwards has seen it but once. It was beaten from sallow (*Salix*) in Foxley Wood, Norfolk, in September. It may be distinguished from other *Idiocera* by its "red-brown colour, and by the breadth and the obliquity of the pale band on the elytron." *Vide* 'Synop. of Brit. Homop. Cicad.,' p. 119.

Idiocerus aurulentus, *Kirschb.*

Mr. Edwards remarks this to be a very variable species "nearly allied to *I. vitreus*, but it does not appear ever to develop the white H so conspicuous on the elytra of that species." Herr Paul Löw says that out of eight specimens in his cabinet no two are alike in colouring. Mr. Edwards seems, in 1883, to have examined only a single example.

It has been taken at Cossey, Norfolk, on the Lombardy poplar.

In concluding the diagnosis of this genus I append a synoptical sketch, as a possible help towards the discrimination of the species.

Synopsis of the Idioceri.

Frons	Suffused with orange in the male... ...	populi
	Trapezoidal	pœcilus
Gulæ	Pubescent	Herrichii
Abdomen	Brown, and ringed with pale margins ...	confusus
	Brown, and not ringed	pœcilus, nubilis
Pygofer	Apex of the male plumose or fringed ...	fulgidus, distinguendus, lituratus
	Apex with cornua	nubilis
Elytra	With bands	tremulæ, distinguendus, elegans, laminatus
	Of uniform tint: ochreous...	confusus
	Of uniform tint: whitish green	albicans
	Of uniform tint: bronzy green	nubilis
	Without bands, but suffused with brown	elegans, fulgidus, populi, adustus
	With dark dashes; nervures piebald ...	varius, Herrichii, lituratus, distinguendus, pœcilus, tibialis
Costæ	With teeth or blunt spines...	adustus

Genus XXIV.—AGALLIA, *Curtis*.

Head with eye broader than the pronotum. Clypeus separated from the frons by a distinct suture. Antennæ of the males not clavate. Each antenna springs from a deep depression formed at the angle of the tumid vertex and the squarish frons. Elytra semi-coriaceous, broad, non-limbate ; costæ arcuate. Some of the usual furcations of the nervures are occasionally wanting, and sometimes the cellules are supernumerary. Abdomen fusiform and pointed. Hind legs multi-spinose.

The species are small, with brownish red spots and lines on the vertex. One of the British forms is brachypterous.

Agallia venosa, *Fall*. Plate XXXVI., figs. 1 to 1*c*.

Cicada venosa, Fall.
Bythoscopus venosus, Panz.
Agallia venosa, Flor ; Marsh. ; Kirschb. ; Sahl. ; Scott ; Edw. pt i. p. 127.

General colour of a dirty ochreous-white. Head broad and obtusely pointed. Pronotum twice longer than the vertex, with five round spots on the upper half and a dark base. Scutellum white. Vertex pointed, with a rusty-red wedge-like mark on the middle, and a smaller red mark on each side. A large black spot occurs near to the wedge, and between it and the eyes. Abdomen brown and flat. Elytra with three or four apical, and three discoidal, cellules. Membrane with brown cloudings and conspicuous nervures. Wings grey. Legs brown, setaceous, and banded with black ; hind tibiæ striped. Frons dirty white, with irregular brown wavy lines and spots. Clypeus with a waving line on each side.

Not common at Haslemere, but plentiful on grasses and low plants in the Romney Marsh and elsewhere; August.

The female is very like the male, but the markings are less pronounced. Sometimes a black spot occurs on each side of the abdominal rings.

	Inch.	Millimetres.
Expanse	0·21	5·33
Size of body	0·10×0·05	2·54×1·27

Agallia puncticeps, *Germ.* Plate XXXVI., figs. 2 to 2*b*.

Jassus puncticeps, Germ.
Agallia consobrina, Curt.; Marsh.
,, *versicolor*, Flor; Kirschb.; Sahl.
,, *puncticeps*, Scott; Edw. pt. i. p. 126.

Rather larger than *A. venosa*. Head and pronotum without the rusty-red marks. Vertex with a large brown mark on each side, between which a grey blotch occurs, which is continued a short distance over the frons. Frons dirty yellow, with two broadish wavy brown lines. Pronotum with a fine brown perpendicular line, crossed by two thicker ones. Scutellum with two triangular marks. Abdomen rusty-brown, long, and widely spread, each segment with a broad dorsal stripe. Legs ochreous, and less striped than in *A. venosa*. Elytra brownish, with dark blotches and brown veins. Wings iridescent. Pygofer complex.

The female is very similar to the male.

	Inch.	Millimètres.
Expanse	0·28	7·20
Body	0·15×0·05	3·81×1·27

Agallia brachyptera, *Boh.*

Athysanus brachypterus, Boh.
Agallia brachyptera, Flor; Kirschb.; Sahl.; Scott; Edw. pt. i. p. 128.

Dirty ochreous or white. Vertex rounded. Eyes brown. Two brown spots on the vertex. Pronotum with a fine brown line, with two oblong spots on each side. Abdomen with dark margins to the segments. Legs pale brown; claws black. The two fore pairs of legs darker than the hind legs. Hind tibiæ finely fringed, the outer edges more coarsely so. Elytra about half the length of the abdomen, with three broad stripes on each. Hind margins narrowly black. Frons dirty white, marked with two smaller and two larger brown spots, succeeded by two fine wavy lines. Antennæ of the males clubbed like those of *Idiocerus*.

	Inch.	Millimètres.
Expanse	0·22	5·59
Body	0·09	2·29

My drawing is from a specimen in Mr. Douglas's cabinet. Mr. Edwards notes that the antennæ are not clavate in *Agallia:* this specimen appears to show them such.

North Cliff, Scarborough, on grass; June.

In reviewing these three last genera it may be seen that the general appearance of *Pediopsis* is much that of *Idiocerus*. The ocelli are almost identically placed on the vertex. The antennæ of the former, Sahlberg describes "in foveis obsoletis insertæ," but in the latter "in foveis profundis insertæ." The neuration of the elytra is variable, particularly in *Pediopsis*, which pretty constantly shows five apical cells; whilst *Idiocerus* shows but four, with the addition of a limbate edge. The wing-veining, also, is practically the same in all

three genera ; but the wings in *Agallia* are shorter than in *Idiocerus*. The male pygofer of the last genus also shows a small genital valve.

The male parts of *Pediopsis tibialis* are quite as complex in structure as we see in *Liburnia :* they are curious objects under the microscope. The clavate antennæ of the male *Idioceri*, it appears, are not peculiar to that genus.

TETTIGONIDÆ.

Frons gibbous. Clypeus very convex. Femora with a pair of spines at their apices. Tibiæ multispinose.

Genus XXV.—TETTIGONIA, *Geoff.*

Frons and clypeus very convex. Ocelli distinct, and placed on the vertex near to the border of the pronotum. Hind femora with a pair of spines on the upper side at the apex (omitted in the figures). Elytra without a limbus, but with a strong apical edge.

Tettigonia viridis, *Linn.* Plate XXXVII., figs. 1 to 10.

Cicada viridis, Linn.
Tettigonia viridis, Germ.; Burm.; Flor; Marsh.; Kirschb.; Sahl.; Edw. pt. ii. p. 15.
T. arundinis, Germ.; Burm.
Amblycephalus viridis, Curt.
Tettigonia flavicatella, Herkl.

The male. Rather smaller than the female. Vertex subgibbous, pale ochreous-brown, with a paler depressed stripe down the middle, and two swollen patches, covered with fine brown parallel striations, on

each side; these patches are continued down to the base of the frons. Ocelli distinct, with two crescentic marks occurring between them. Eyes pale brown, and mostly spotted. Pronotum greenish yellow, with irregular brown spots. Legs ochreous; claws black. Two spines on each femoral tip. Tibiæ fringed with setæ. No genital valve. Elytra longer than abdomen, generally blackish blue, but sometimes all green. A broad paler blue spot, succeeded by a crescent of black, occurs towards the apex. The apical end is membranaceous and brown. Nervures black. Abdomen blue-black and glaucous. Wings grey.

The female is brighter than than the male, and is of a fine emerald-green, with a brownish head. The pronotum, scutellum, and all the elytra, green; and spotted on the anterior parts with black. The costa is palish yellow. The female pygofer has a crescentic notch, with a bin-articulate cauda. The ovipositor has several blades, two of which are serrated; magnified representations of which may be seen in figs. 9 and 10.

This handsome species is very common at Haslemere, at Godalming, and in many marshy and rushy parts. The variety *T. arundinis*, Germ., is pale, with the nervures narrowly bordered with black.

Some remarks as to the habits and the life-history of this insect will be found on pages lxvii., lxx. of the Introduction. The species is in a manner gregarious; five or six individuals congregating on the same rush, head to tail, all up the stalk. They repeatedly void, with some force, drops of liquid from the anus, just as do many of the Aphides which secrete the honey dew.

Euacanthus interruptus, the next described species, seems to live in harmony with *Tettigonia*, and to feed amicably on the same stems.

Length of body and elytra, 0·472 inch, or 8·5 millimètres.

Genus XXVI.—EUACANTHUS, *Lep. et Serv.*

Head with eyes broader than the thorax. Ocelli distinct, and placed on the margin of the vertex. Rostrum equal to the length of the clypeus. Elytra coriaceous; nervures raised. Anterior tibiæ smooth; inner side setose. Hind tibiæ quadri-prismatic, strongly spined and setose.

Euacanthus interruptus, *Linn.* Plate XXXVIII., figs. 1 to 1*f*.

Cicada interrupta, Linn.; Fab.; Fall.
Amblycephalus interruptus, Curt.
Euacanthus interruptus, Burm.; Flor; Marsh.; Kirsch.; Sahl.; Edw. pt. ii. p. 14.

Body long, tapering much to the tail. Head with eyes broader than the pronotum. Ocelli distinct, and placed on the anterior margin of the vertex. Pronotum squarish, with lower margin obscurely emarginate. Scutellum triangular. Abdomen acuminate. Elytra dense, bright yellow, with a broad black unequal bar proceeding from the base to the apex, traversing part of the corium and the clavus; another black mark proceeds from the apex, and becomes narrower as it stretches over the rest of the corium. Legs yellow. Fore and middle tibiæ sparsely ciliated; the hind tibiæ spined and setose.

The venation of the elytra is difficult to make out, as the nervures lose themselves in the transparent parchment-like texture. According to Fieber's figure there are one costal, one cubital, one basal, one subcubital, one discoidal, and four apical cells. The clavus is nearly as large as the corium.

This insect occurs in two forms; apparently in different conditions of development, which Sahlberg

marks as Macroptera and Brachyptera; the wings and elytra being either equal in length or shorter than the abdomen. Moreover, the species is liable to much variation in colouring. Probably insular and continental forms somewhat differ in these particulars.

	Inch.	Millimètres.
Expanse	0·36	9·14
Body	0·26	6·60

Euacanthus acuminatus, *Fab.*

Amblycephalus Germari, Curt.
Euacanthus acuminatus, Burm.; Flor; Marsh.; Kirschb.; Sahl.; Edw. pt. ii. p. 14.

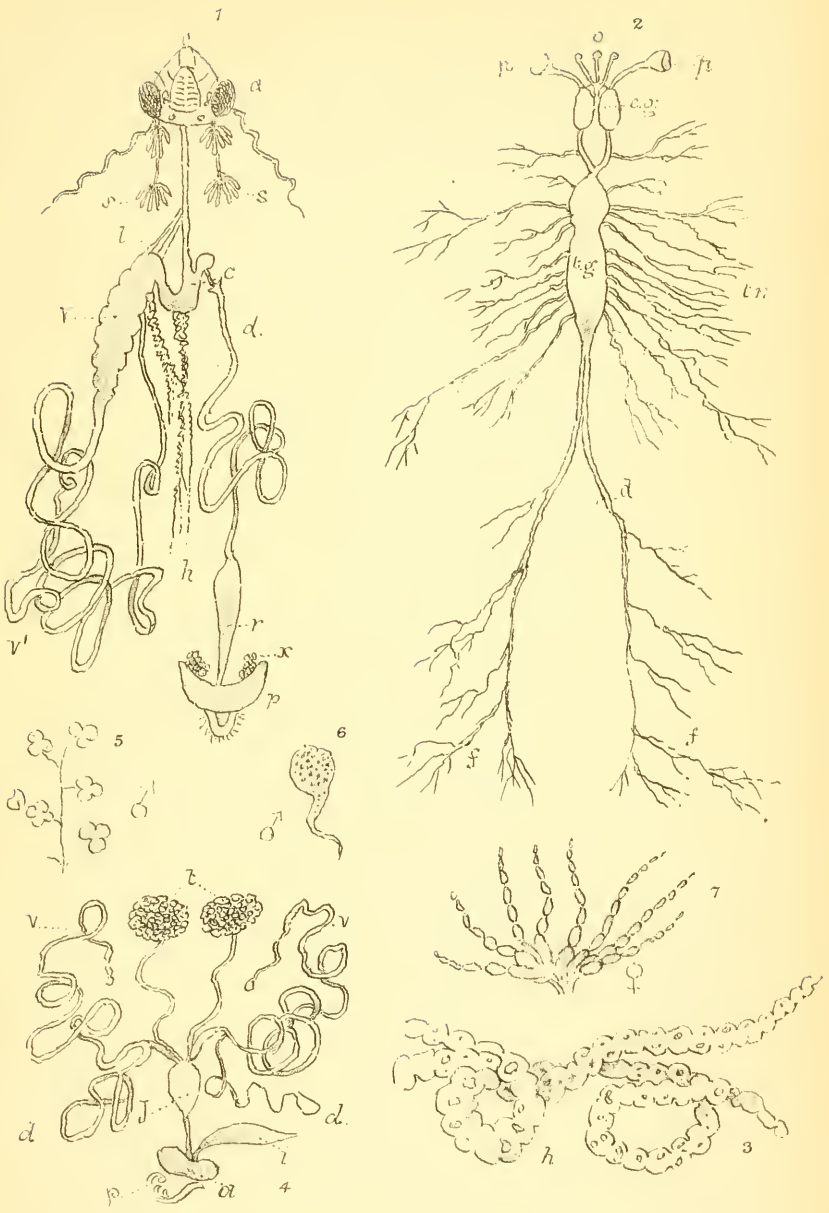
Frons of the male dark brown or black. Crown black. The rest of the colouring, from description, does not seem much to differ from the preceding species. I have not seen specimens sufficiently distinct in character to require a figure. Mr. Edwards says *E. acuminatus* is common.

Euacanthus interruptus is accused of doing injury to the English hop-vines. Personally I have nowhere met with the insect in such abundance as to lead to the supposition that it can commercially affect us. It is largely spread over Great Britain, and it finds its food on many different plants.

In July I saw many infesting the furze bushes (*Ulex*) on the tops of the high cliffs near Freshwater. I have taken them also on the rushes at Haslemere, and on the chalk downs near Marlborough. They occur also on the shores of Milford Haven, and other places.

The larvæ are of a singular form, and somewhat uncouth, with their dark eyes and erect banded bodies.

The imago is dimorphous, often brachelytrous, or even without wings. It may be taken in July and August.



J.B.B. del et lith.

West, Newman imp.

PLATE XXXI.

Pediopsis distinctus. (Page 101.)

Fig. 1.—The imago.

Fig. 1 *a*.—Represents the profile of the frons, and the insertion of the antennæ in *Pediopsis scutellatus*.

Fig. 1 *b*.—Represents the more flattened frons of *P. virescens*.

Idiocerus fulgidus. (Page 107.)

Fig. 2.—The imago with closed wings.

Fig. 2 *a*.—The clavate antenna of the male.

Fig. 2 *b*.—The frons and clypeus of the same.

Fig. 2 *c*.—The apex of the abdomen of the male, seen from above, with its plumose penis.

Fig. 2 *d*.—The same parts seen in profile, with one of the cornua, much magnified.

Idiocerus populi. (Page 108.)

Fig. 3. — The imago.

Idiocerus adustus. (Page 109.)

Fig. 4. — The imago, with closed elytra.

Fig. 4 *a*.—Front view of the male frons, and the front legs.

Fig. 4 *b*. — Elytron, showing the costal teeth. Several of the nervures cannot be traced in the chitin.

1
1a.
1b.
2a.
2c.
♂ 4a.
2d.
2b.
4b
4
2
3

PLATE XXXII.

IDIOCERUS CONFUSUS. (Page 109.)

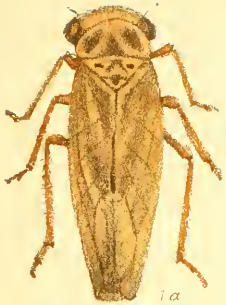
Fig. 1.—Imago with expanded wings.
Fig. 1 *a*.—The female with closed elytra.
Fig. 1 *b*.—The elytron with its limbus. Some of the transverse veins are often found to be wanting.
Fig. 1 *c*.—Hind tarsus and claw.

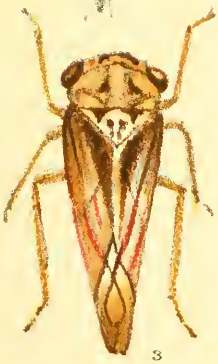
IDIOCERUS LAMINATUS. (Page 110.)

Fig. 2.—Imago.
Fig. 2 *a*.—Head, showing the frons and clypeus.
Fig. 2 *b*.—The three last abdominal rings.

IDIOCERUS VITREUS. (Page 111.)

Fig. 3.—Imago.
Fig. 3 *a*.—Head, pronotum, and scutellum.
Fig. 3 *b*.—Head, showing the frons and antennæ from the front aspect.





G.B.B del. et lith.

West, Newman chromo.

PLATE XXXIII.

Idiocerus varius. (Page 111.)

Fig. 1.—The imago with its brocaded elytra.
Fig. 1 *a*.—Dorsal aspect of the head and pronotum.

Idiocerus Herrichii. (Page 112.)

Fig. 2. — Imago, one elytron folded over the back.
Fig. 2 *a*.—Front view of head and legs.
Fig. 2*b*.—Elytron, showing the thickened and ribbed costa.
Fig. 2*c*. — Fore leg with its tarsus and claws.

Idiocerus lituratus. (Page 113.)

Fig. 3. — Imago.
Fig. 3*a*.—Frons, clypeus and rostrum.
Fig. 3*b*.—Last abdominal rings, with the rounded plate and three setæ, of the male.
Fig. 3*c*. — Under-side of the female pygofer and saw-case.
Fig. 3*d*. — Elytron with its pigmental spots and curved dark lines.

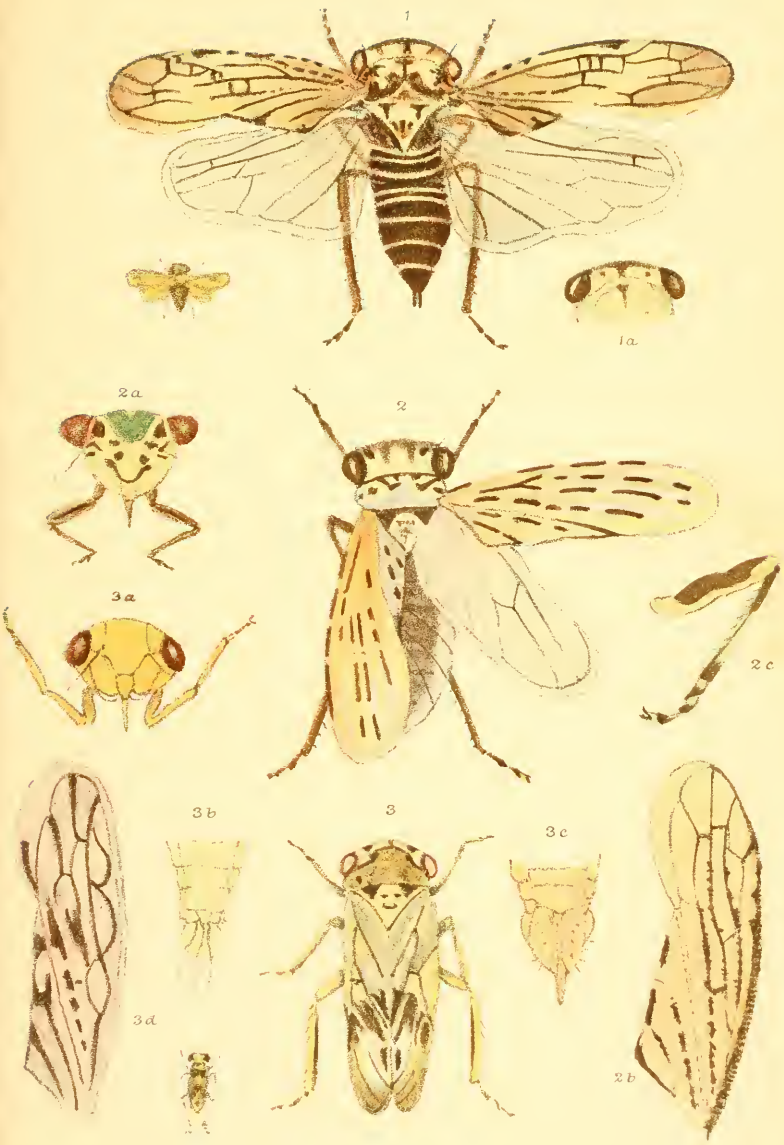

1
1a
2a
2
2c
3a
3b
3
3c
3d
2b

PLATE XXXIV.

Idiocerus distinguendus. (Page 115.)

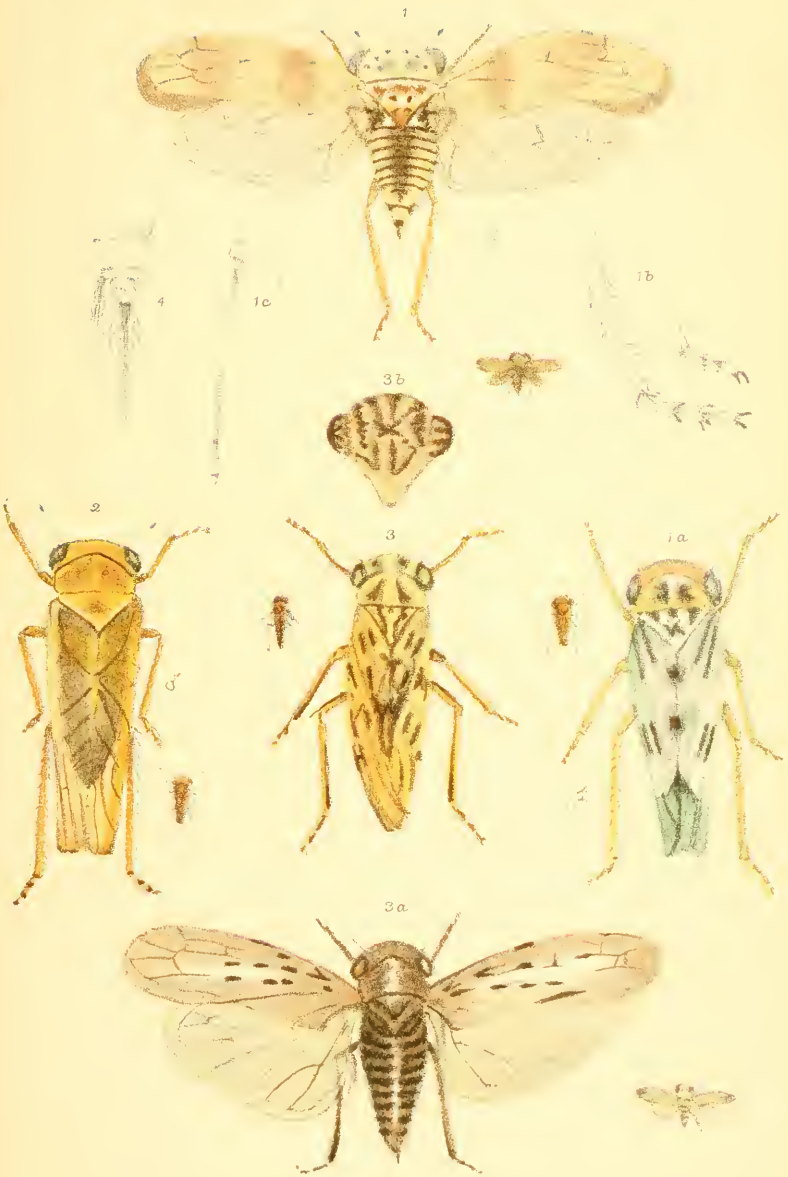
Fig. 1. —Imago of the male.
Fig. 1 *a*.—Imago of the variety *cognatus*.
Fig. 1 *b*. — Hind and fore tarsi.
Fig. 1 *c*.—Clavate antenna of the male.

Idiocerus albicans. (Page 114.)

Fig. 2.—Imago of the male. The whiter variety is drawn on Plate XXXV., fig. 2.

Idiocerus pœcilus. (Page 114.)

Fig. 3.—Variety called *falciger*.
Fig. 3 *a*.—Imago of a darker insect.
Fig. 4.—The abdominal apex of the male insect.



G B B del et lith

West, Newman ch. imp.

PLATE XXXV.

Idiocerus tremulæ. (Page 116.)

Fig. 1.—Imago of the female.
Fig. 2.—Nearly colourless imago of *I. albicans*. See Plate XXXIV.

Idiocerus elegans. (Page 117.)

Fig. 3.—Imago.
Fig. 3 *a*.—Female with wings closed.

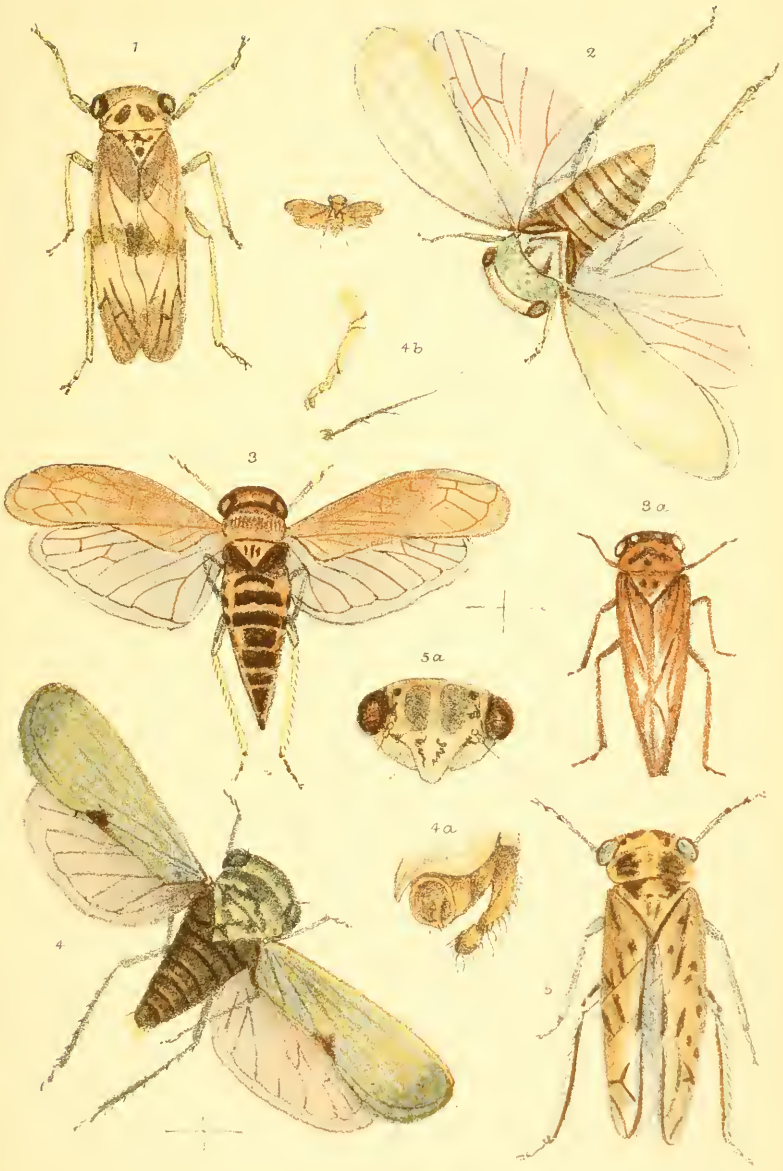
Idiocerus nubilis. (Page 118.)

Fig. 4.—Imago with expanded wings.
Fig. 4 *a*.—Genitalia of the male, with its cornua, anal process, and cauda. A side view.
Fig. 4 *b*. — Hind tarsus and antennæ of the same.

Idiocerus tibialis. (Page 119.)

Fig. 5. — Imago.
Fig. 5 *a*.—Frons, clypeus, &c., of the same insect.

PLATE XXXV.



G.B.B. del et lith.

West Newman ar[illegible]

PLATE XXXVI.

Agallia venosa. (Page 121.)

Fig. 1.—Imago.

Fig. 1*a*.—Another example, showing brown bars on the elytra.

Fig. 1*b*.—Front view of the head of the same insect.

Fig. 1 *c*.—Antenna.

Agallia puncticeps. (Page 122.)

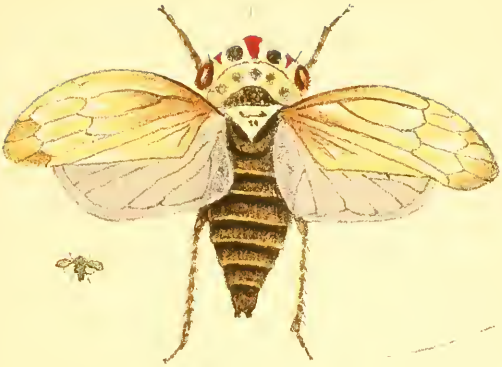
Fig. 2.—Imago.

Fig. 2*a*.—Front view, showing the frons, clypeus, and fore legs, banded with brown.

Fig. 2 *b*.—Under-side, showing part of the male pygofer, with its cauda and styles.

Agallia brachyptera. (Page 123.)

Fig. 3.—The female insect, with its half-developed elytra.



1c

2

1b

2a

3

2b

1a

PLATE XXXVII.

TETTIGONIA VIRIDIS. (Page 124.)

Fig. 1. — The female. The elytra show their Hemipterous character in the semi-membranaceous texture of their apices.

Fig. 2.—The male insect seen in profile.

Fig. 3.—The head, pronotum, and scutellum of the female. The tumid character of the vertex, the pigmental spots of the eyes, and the situation of the ocelli are here well marked.

Fig. 4.—Frons and clypeus, the former striated.

Fig. 5. — An elytron showing the thickened marginal nerve.

Fig. 6.—The wing.

Fig. 7. — The trimerous tarsus of the hind leg. By inadvertence the two spurs on the femora, which are noted in the text, have been omitted in fig. 1.

Fig. 8.—The cleft termination of the male pygofer.

Fig. 9.—A portion of the complex saw-apparatus of the female. Two horny and serrated laminæ have been dissected out. Each lamina is strengthened by two chitinous ridges, and towards the point a portion is roughened, so as to act, probably, like a rasp.

Fig. 10. — A portion of the saw more highly magnified. The ova pass down the channel made by these saws and their sheaths, into the groove excavated.

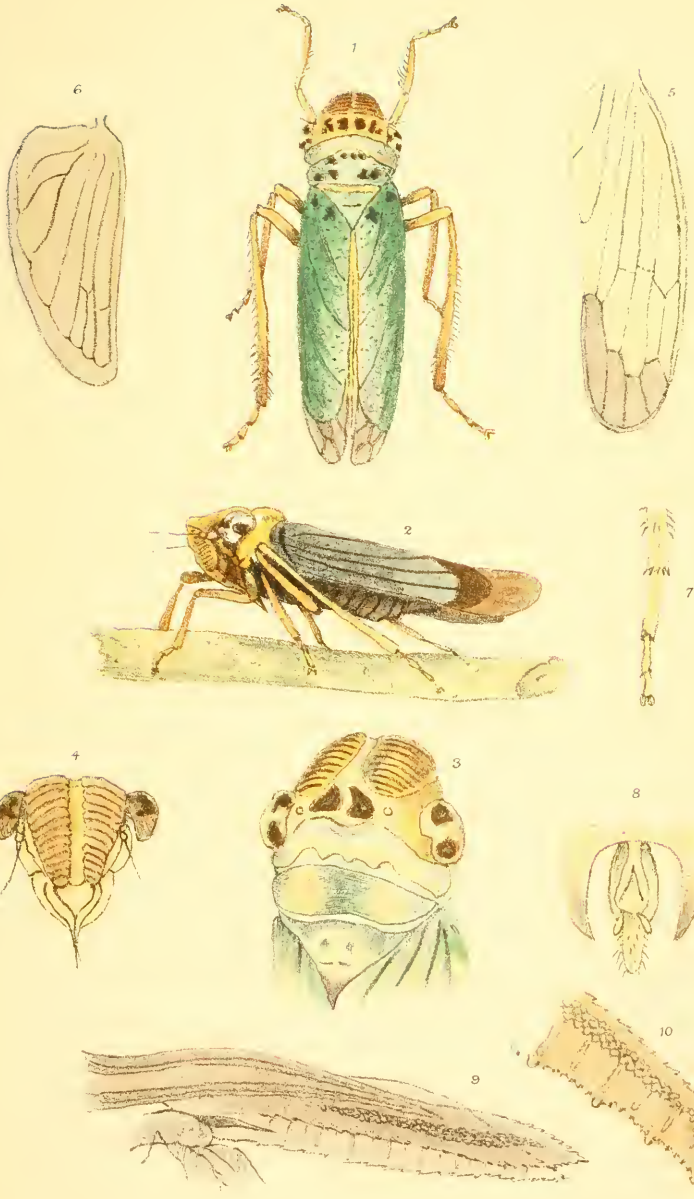


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PLATE XXXVIII.

Euacanthus interruptus. (Page 126.)

Fig. 1. — Imago. The wings are small, and not fully developed in this example.

Fig. 1 *a*.—Larval form. The wing-cases are soldered together, and not free from the abdomen.

Fig. 1 *b*.—Pupa seen from the ventral aspect. The wing-cases here are disengaged.

Fig. 1 *c*.—Head and frons of the imago.

Fig. 1 *d*.—Pygofer of the female, with its cylindrical cauda and part of the saw-case.

Fig. 1 *e*.—Wing of fig. 1, with its neuration.

Fig. 1 *f*.—Hind tarsal joints and pulvilli. The first joint is much the largest.

Eupelix cuspidata. (Vol. ii.)

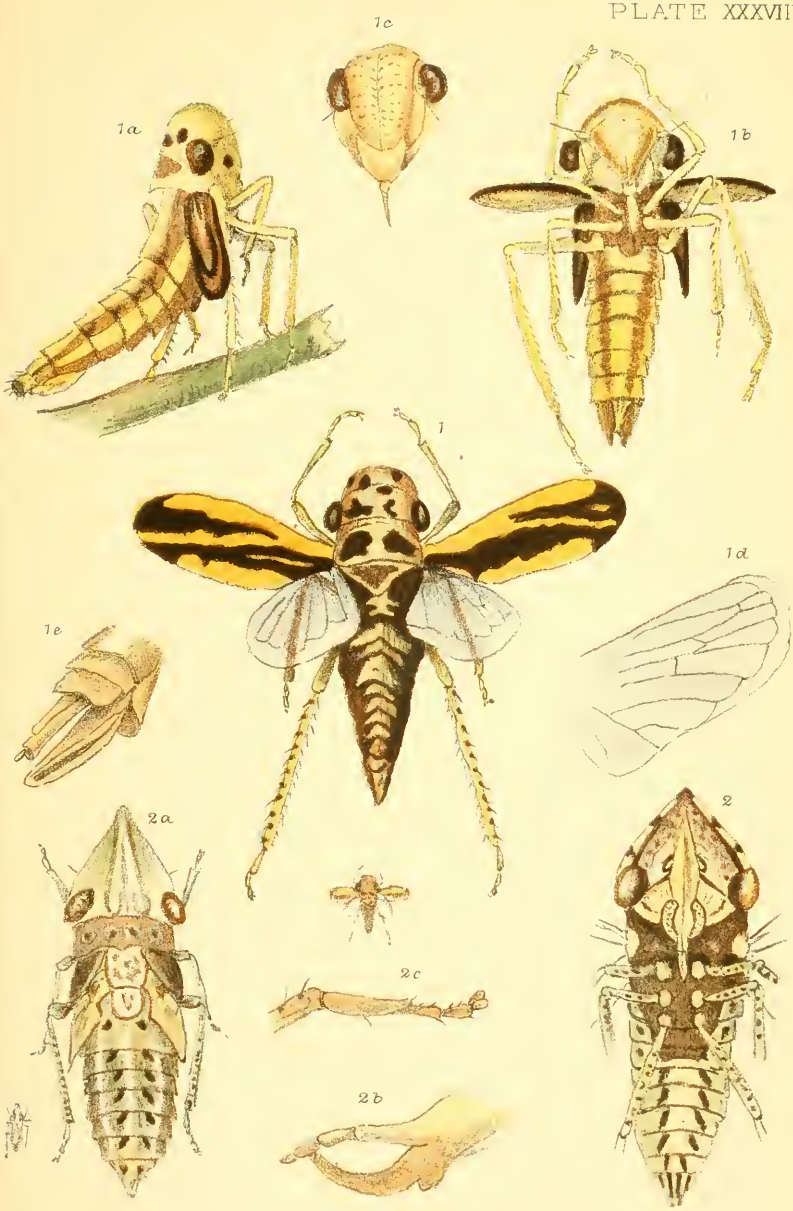
Fig. 2. — The pupa, showing the projecting vertex with its ridges.

Fig. 2 *a*.—Under-side of the imago, with its frons, clypeus, and rostrum, *in situ*.

Fig. 2 *b*. — Shows the peculiar cleft form of the abdominal apex.

N.B.—Figures of the imago will be found on the next plate, vol. ii.

PLATE XXXVIII.



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INDEX TO VOL. I.

PAGE

Abdomen, number of rings in . . . xlix
Acrotile bivittata . 74, 77
Æstheticism in insects . lxxi
Agallia . . . 121
— brachyptera . . 123
— *consobrina* . . 122
— puncticeps . . 122
— venosa . . . 121
Allingham, William, translation of an Anacreontic ode to the Tettix . xiv
Alimentary system . . lix
Amblycephalus viridis . 124
Anacreontic odes to the Tettix . . . xiii
Antenna, supposed functions of . . . xlvi
Aphrophoridæ . . 82
Aphrophora alni . . 82
— *gondotii* . . . 85
— salicis . . . 83
Apollo and Tettix on Greek coins . . . viii
Aristotle, on Tettix and Achetes . . . ix
Arœopus crassicornis . 29
Asiraca clavicornis . . 28
Aspects for drawing under the microscope . lxxvii
Aurora and Tithonus . xi

Benefits from Tettigidæ . lxxv
Bibliographic list of authors xx

PAGE

Browning, Robert, on the Lyre-contest with the Cicada . . . xviii
Buddhist notions on the Cicada . . . vii
Burgon, Dean, on Psychic ideas and the Cicada . viii
Burmeister, on Cicadæ . xxv
Bythoscopidæ . . 94
Bythoscopus alni . . 97
— flavicollis . . 98
— rufusculus . . 98

C and S, are they interchangeable? . . . v
Capture of Cicadæ by Chinese boys . . . xviii
Cercopes of the Ancients . 79
Cercopidæ . . . 77
Cercopis colcoptrata . 11
— *sanguinolenta* . . 80
Cercopis Dionysii . . 19
Chinese wax, nature of . lxxvi
Centrotus *chloraticus* . 7
— cornutus . . . 6
— *genistæ* . . . 7
Chloriona farinosa . . 75
— *smaragdula* . . 34
Cicadæ caged for pots . xii
Cicada *anglica* . . 1
— *coleoptrata* . . 11
— *fulgida* . . . 107
— *hæmatodes* . . 1
— *leporina* . . . 17

	PAGE
Cicada *montana*	1
— *nervosa-punctata*	19
— *orni*	1
— "exemplar morum"	xxi
— *populi*	108
— *stigmatica*	19
Cicadetta montana	1
Cicadinæ	xxxiv
Circulating system	lviii
Cixiidæ	13
— Synopsis of	24
— Secretion of wax by	13
Cixius albicinctus	21
— brachycranus	20
— *contaminatus*	21
— cunicularius	19
— *musivus*	19
— *distinguendus*	19
— nervosus	18
— pilosus	21
— remotus	23
— similis	22
— simplex	22
— stigmaticus	19
— Synopsis of	24
Classification of the Tettigidæ	xxxi
Colour a lure to insects	lxxii
Concealment from protective colours	lxx
Conomelus limbatus	60
Cowper and Cowley, on the Tettix	xv
Curtis, J., illustrations of Cicadæ	xxvii
DeGeer, sur les petites Cigales	xxiv
Degradation of wings from disuse	27
Delphacidæ	25
— Styloid processes of	25
— Synopsis of	28
Delphax *clavicornis*	28
— *colorata*	31
— *dubia*	29
— *fuscovittata*	31
— *guttulifera*	32
— *hemiptera*	48
— *lineola*	30
— *longifrons*	31
— *marginata*	48
— *Minki*	29
— *notula*	30
Delphax *pictipennis*	60
— pulchella	29
— saccharivora	lxxiv
— *saturalis*	48
Development, arrest of	26
Diable, le petit	6
Dicranotropis hamata	66
Disraeli, Isaac, as to spare diet	lxxvi
Ditropis pteridis	72
Dubois, Dr., experiments on insect luminosity	10
Earthen tubes, pupation of Cicadæ in	5
Eggs of Cicadæ eaten as delicacies	xxiv
Elytra, neuration of	li
Etymology of "Tettix"	iii
Euacanthus	126
— acuminatus	127
— interruptus	126
Eurybregma nigrolineata	71
Euides speciosa	52
Eurysa vittata	62
Facial keels	28
Fieber's 'Cicad. d'Europe'	xxviii
Filippo de Filippi, on the sounds made by Cicadæ	lv
Flata cunicularia	19
— *pallida*	16
— *simplex*	22
Food, choice of	lxix
Forel, Dr., on blind insects of the deep Swiss lakes	xlv
Fossil species, value of	81
Froghoppers and cuckoo-spits	ii
Fulgora candellaria	9
— Mad. Merion on	8
— non-luminous?	9
Fulgorinæ	xxxiv, 8, 9
Gargara genistæ	7
Germar, Curtis, Flor, on Cicadæ	xxvii
Golden Tettiges of the Athenians	xi
Gosse, Edmund, on Anacreontic odes	xiv, xv
Grasshoppers confounded with Cicadæ	xvi

PAGE

Grasshoppers of Scripture . xvi
Greek coins with the Tettix . xix

Habitats and nesting-places . lxx
Habits of Tettigonia . lxiv
Hearing organs tested with Mr. F. Galton's whistles lxiv
Homer and Hesiod, on Tettix . . vi, xii
Hunter, John, and Charles Darwin, on secondary sexual characters . 25

Idiocerus . . . 106
— adustus . . . 109
— *affinis* . . . 119
— albicans . . . 114
— aurulentus . . 120
— *cognatus* . . . 115
— confusus . . . 109
— distinguendus . . 115
— elegans . . . 117
— *falciger* . . . 114
— fulgidus . . . 107
— *H-album* . . . 111
— Herrichii . . . 112
— *Heydeni* . . . 119
— laminatus . . 110
— lituratus . . . 113
— *maculipennis* . . 113
— nubilis . . . 118
— pœcilus . . . 114
— populi . . . 108
— tibialis . . . 119
— tremulæ . . . 116
— *unifasciatus* . . 116
— varius . . . 111
— *venustus* . . . 114
— viduatus . . . 119
— vitreus . . . 111
— Synopsis of . . 120
Injuries done by Cicadæ . lxxiv
Issidæ . . . 11
Issus coleoptratus . . 11

Jassinæ . . xxxiv
Jassides (see Corrigenda) . 94
Jassus lanio . . . 95

Kelisia guttula . . 38
Kelisia vittipennis . . 32
Kirby and Spence, on Cicada 3

Lantern flies . . . 9
Latin and Italian dialects contrasted . . iv
Latreille, Fallen, Stal, Westwood . . . xxvi
Ledra aurita . . . 89
Legs and tarsi for leaping . xlix
Léon Dufour, on anatomy of Cicadæ . . . xxv
Lepori, Prof., on the sounding órgans of Cicada . lv
Liburnia adela . . 39
— *albo-fimbriata* . . 44
— Aubei . . . 59
— brevipennis . . 56
— capnodes . . . 41
— collina . . . 35
— *consanguinea* . . 46
— *curtula* . . . 41
— denticauda . . 51
— discolor . . . 50
— difficilis . . . 49
— discreta . . . 49
— distincta . . . 46
— Douglasi . . . 57
— elegantula . . 36
— exigua . . . 52
— Fairmairei . . 56
— Fieberi . . . 39
— flaveola . . . 62
— forcipata . . . 54
— fuscovittata . . 31
— guttula . . . 38
— leptosoma . . 44
— limbata . . . 60
— lineola . . . 31
— lineata . . . 62
— lepida . . . 37
— longipennis . . 32
— lugubrina . . . 45
— mesomela . . 58
— *neglecta* . . . 56
— notula . . . 30
— obscurella . . 55
— pallidula . . . 42
— pellucida . . . 48
— pullula . . . 47
— Reyi . . . 53
— *rhypara* . . . 41
— Scotti . . . 33

	PAGE
Liburnia scutellata	44
— Signoreti	40
— smaragdula	34
— speciosa	52
— straminea	63
— striatella	55
— unicolor	35
— *V-flava*	63
— venosa	41
— vittipennis	32
— Ova of	43
Life-history of Tettigidæ	lxiii
Limbus or Appendix	li
Linnæus, Burmeister	xxv
Luminosity of insects	9
Macropsis lanio	95
— microcephala	95
Macropterous and brachypterous forms	27
Males, brighter colours of	lxviii
Medicinal uses of Cicadæ	lxxvi
Megamelus	30
Megophthalmus scanicus	93
Melampsalta montana	1
Membracidæ	5
Membracis cornuta	6
Metamorphosis, Cibarian and Alary groups	xxxii
Milne-Edwards, on trivial characters	xxxviii
Morgan, C. L., on wax secretion	13
Middlemiss, C., on singing organs of Cicada	lvii
Moufet, Thos., on frugality, &c.	xxi
Musical pitch of the Cicada's song, Prof. Riley on	5
Mutilation, effects of	liii
Myths relating to Cicadæ	vii
Notes on classification	xxxii
Notonecta and Cicada	xxi
Ocelli, functions of	xliii
Oculi, anatomy and functions of	xliv
Odours, effects on insects	lxxii
Olearus leporinus	16, 17
— pallidus	16
Oxyrhachis genistæ	7
Ova in Cicada and Pediopsis	lxii, lxviii
Paracelsus and Hesychius	xii
Paropidæ	88
Pediopsis	99
— cereus	104
— distinctus	101
— fuscinervis	102
— impurus	101
— nanus	102
— nasatus	104
— *prasinus*	100
— scutellatus	105
— tibialis	105
— tiliæ	103
— ulmi	103
— virescens	100
— Synopsis of	100
Pentastira leporina	17
Philænus campestris	88
— exclamationis	87
— lineatus	87
— spumarius	84
— Varieties of: — fasciatus, leucocephalus, leucophthalmus, populi	86
Philænus of the coffee-plant	87
Prey to Hymenoptera, Cicadæ	85
Plato, on Tettix and the Muses	viii, xii
Ptyelus spumarius	84
Pupæ and larvæ, incomplete metamorphosis	lxviii
Pygofer and Pygothèque	liii
Pyrophorus noctilucens	9
Réaumur, sur les Cigales	xxii
— on the singing of	xxiii
Rostrum and labial lancets	xlvii
Sahlberg, John, on Cicadinæ	xxix, xxxvii
Sauterelles puces, Swammerdam	xxv
Saws of ovipositor	liv
Schemes of classification	xxxv
Scott, John, and Douglas, J. W.	xxx

PAGE
Sexual characters, secondary, John Hunter and Chas. Darwin . . . 25
Signoret, Victor, sur les Jassides . . . xxix
Silky flocks from Aphides and Cicadæ . . 14
Smell, action of scent through stomata . . . lxi
Solinus, on Locrian fancies . x
Song of the Cicada . . ix
Sounding organs . . lv
Spume of the cuckoo-spit, nature of the . . 78
Stenocarenus guttuliferus . 32
— *minutus* . . . 31
Stenocranus fuscovenosus . 31
— *fuscovittatus* . . 31
— *lineolus* . . . 31
— *longipennis* . . 32
Stiroma albomarginata . 69
— affinis . . . 70
— bicarinata . . 73
— borealis . . . 70
— nigrolineata . . 71
— pteridis . . . 72
— Frontal tubercles on the larval forms . . 74
Stomata, position of . . xlix
Strabo, tale of Eunonias and Aristomus . . ix
Stridulation wanting in the female Cicadæ . . lxxvi
Synopsides, Tettigidæ . xxxiv
— Cixiidæ . . . 24
— Delphacidæ . . 28
— Idioceri . . . 120

PAGE
Temperature, immunity to cold lxix
Tennyson, Alfred, Lord, allusion in "Œnone" to Cicala . . . xvii
Terminology . . . xlii
Tetta, "papa," "dada" . v
Tettiges as ornaments . xix
Tettigometra impresso-punctata . . . 10
— *concolor* . . . 11
Tettigonia viridis . . 124
— *arundinis* . . 124
Tettix used as a charm . xi
Thorax, pro- and meta- . xlviii
Touch and taste . . lxii
Tozzetti, Targioni, Prof., on the song of Cicadæ . lv
Triecphora vulnerata . 80

Ulopa reticulata . . 90
— trivia . . . 92
Ulopidæ . . . 90

Water Cicada . . lxx
Wax from Cicadæ . lxxvii
— from Cixiidæ . 13, 15
Westwood, Professor J., and Francis Walker . . xxvii
Wings and atavism . . lxxiii

Variability of Tettigidæ . 26, 86

Xenarchus, on voiceless female Cicadæ . . lxxvi

Errata and Corrigenda.

Page ii, line 16, *for* "æ" *read* "œ."
Page iii, line 1, *for* "biological" *read* "bibliographic."
Page vi, line 8, *for* "Moufat" *read* "Moufet," and in other places.
Page ix, at footnote, *for* "Departibus" *read* "De Partibus."
Page xxii, line 13, *dele* "Réaumur?"
Page xxix, *for* "Sahlsberg" *read* "Sahlberg."

Page 1, above Genus I., *insert* "CICADINÆ."
,, ,, line 15, for "*Cicadetta*" read "*Cicada.*"
Page 2, line 3, *for* "fossi" *read* "fossæ."
Page 5, *for* "II. MEMBRACIDÆ" *read* "MEMBRACINÆ."
Page 10, *for* Genus I. *read* Genus IV.
Page 11, ,, ,, I. ,, ,, V.
Page 16, ,, ,, I. ,, ,, VI.
Page 18, ,, ,, I. ,, ,, VII.
Page 80, above "TRIECPHORA" *read* "CERCOPINÆ."
Page 94, above "BYTHOSCOPIDÆ" *read* "JASSINÆ."

Some apology may be necessary for the too hasty glance bestowed on the lengthy Epistola and the Præfatio to "Old Moufet's" 'Theatrum Insectorum.' It is apart from the object of this Monograph to debate the question how far Thomas Moufet's work, printed in 1634, is a mere compilation. More was claimed for the book by the writer of its title-page.

The present note is added to correct an erroneous impression conveyed by the remark made on page xxii. of my Introduction, that Dr. Thomas Moufet was the writer of this Epistola, instead of Sir Theodor Meyerne, who was partly instrumental in bringing the manuscript of the 'Theatrum' before the public. "The illustrious William Paddy" appears to have been the intelligent dissector, noted on page 5 of the Epistola. Moufet, or Mouffet, was born about the year 1550, and appears to have died in obscurity, some few years before the 'Theatrum' was printed by Hope.

The above corrigendum will not be thought perhaps to be of much moment by the entomologist, though it may be of some interest to the literary man.

End of Volume I.

WEST, NEWMAN AND CO., PRINTERS, HATTON GARDEN, LONDON, E.C.

MONOGRAPH

OF THE

BRITISH CICADÆ

(Froghoppers and Grassflies).

By GEORGE BOWDLER BUCKTON, F.R.S., &c.

The comparison of specimen with specimen is the basis of all zoological and biological research. Doubtless, after living forms, collation with museum specimens is of the greatest use to the investigator. Such specimens, however, are not open to the use of many, and to those who have no access to them, monographs are of prime importance.

It will be admitted that every enlightened and civilised country ought to concern itself with the description of its Fauna and Flora. Quite apart from an economic point of view, it is incumbent on us to help forward the progress of knowledge, and to accumulate materials for comparing present living forms with those varieties which may proceed from them in future years; and these materials will assist in the elucidation of some of the far-reaching developmental problems under discussion at the present time.

No coloured monograph of the British Cicadæ exists, and it is even believed that no adequately illustrated monograph exists of European species. Partly to meet this want, it is proposed to publish eight quarterly Parts, each containing on an average ten litho-chromo plates and letterpress, illustrating the forms, metamorphoses, general anatomy, and the chief details connected with the life-history of this family of insects.

The work will contain also short diagnoses of all the British species, about 230 in number, most of which have come under the author's notice, each species being illustrated by one or more coloured drawings. Some account will be given of the curious myths and tales told by ancient Greek and Latin poets, and descriptions will be appended relating to the curious sound-organs possessed by some species, and other subjects connected with the economy of this interesting but difficult group of Rhynchotous insects.

It is believed that by the help of the numerous camera-lucida drawings, which will appear in this Monograph, many of which have been made from type specimens in the cabinets of Mr. J. W. Douglas and Mr. James Edwards, the identification of nearly-allied species will be facilitated.

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